Special Edition: The Organic Breeding Debate

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Imprint

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All articles and correspondence solely concerned with Ecology and Farming should be sent to letters@ifom.org

All advertising queries should be directed to the IFOAM Head Office.
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The Organic Standard

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The Organic Standard is a monthly journal published by Grolink. Distributed by email as a pdf file the journal deals with issues concerning international organic standards, regulations and certification.
Along with the soil, sunlight, and water, there is nothing more important to any form of agriculture than its basic breeding material – seeds and livestock.

And in the world of organic agriculture this all important basis of production has also become one of the “hottest” subjects of debate and one of the central definers of what modern organic farming is all about.

What is organic seed? How to define organic livestock genetic lines? Is there any role for genetic modification in organic systems? How can “small-scale” organic seed production and organic livestock breeding thrive amongst the cut and thrust of agricultural breeding, dominated as it is by big money, large-scale agribusiness? How can organic farming play the fullest role in agricultural biodiversity?

These are the very questions which drove IFOAM to hold the 1st International Conference on Organic Animal and Plant Breeding – Breeding Diversity – in Santa Fe, New Mexico, USA in August 2009.

The conference showcased the fostering and sustainable development of new successful, low input seeds and animals. Their development is now particularly urgent in the face of future challenges of food insecurity and the massive threats to the livelihoods of millions of people caused by climate change.

It’s also why IFOAM is currently consulting on the development of its position paper on the use of organic seed and propagation materials in organic agriculture and it’s why this edition of Ecology and Farming is dedicated as an organic breeding “special”.

In the following pages Edith Lammerts examines the ethics of organic breeding material set against the four key principles of IFOAM – health, ecology, fairness and care. We report the inspiring stories of indigenous rice breeding in the Philippines and a resurgence of indigenous livestock breeds in India. And we ask, do dwarfing genes have a place in organic cereal systems?

Of course central to the future of a thriving organic seed and livestock sector is the resolution of ownership, intellectual property and pricing. As Annemieke van den Dool writes in her article, the success achieved by the open source and free software movement sets an example for the organic breeding sector. With biotechnology lurking in the wings, it is of utmost importance and urgency to now develop an alternative – Open Source Biology – system.

I hope these articles will stimulate thought and discussion. Do please get in touch to add your voice to the organic breeding debate – letters@ifoam.org.

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The world-wide area of arable land has decreased dramatically over the past decades. According to latest FAO statistics, an average of 2137 m² arable land per person was available in 2007, in comparison to 4307 m² in 1961. This decline in arable land is caused through two major factors: the loss of fertile topsoil and the rapid growth of the world’s population. During the last 50 years, the number of people has increased from 2 to almost 7 billion. On the other hand, about 12 Mio. hectares of fertile top soil are lost annually due to non sustainable agricultural practices such as over fertilization, and intensive monocultures, causing erosion and other negative impacts. Due to this development, the demand for high quality compost as an alternative to synthetic fertilizers has grown rapidly during the last years. Even more and more conventional growers have realized that farming systems based on synthetic fertilizer use are not commercially profitable in the long run.
Initially delivering high yields, soil fertility and with it yields rapidly decrease after a few years already, whilst fertilizer application needs to be maintained, or even increased. This results in higher input costs per unit produced.

Based on these observations, Soil & More International BV was founded in 2007. The company aims to contribute to soil fertility through the production of high quality compost, and to improve the sustainable competitiveness of the agricultural sector through advisory services in the field of carbon, water and sustainability footprinting. The company is active in the setting-up and management of large-scale composting sites and sustainability consultancy in developing and emerging countries such as Brazil, Egypt, Ethiopia, Mexico, India, and South Africa. Soil & More’s innovative composting technology is based on methods developed by E. Pfeiffer (1899-1961), one of the pioneers of the organic and biodynamic movement, and qualifies as an emission reduction methodology according to UNFCCC guidelines. Currently, Soil & More generates carbon credits through methane avoidance. The compost is produced using unwanted biomass and manures which, if not used for composting, would have (mostly) been land filled and left to rot anaerobically, thus emitting methane.

Together with its partners, primarily organic and biodynamic growers in Egypt, India, Mexico and South Africa, Soil & More produces about 170,000 tons of compost annually, which goes along with an emission reduction of over 150,000 tons CO₂e. Currently, the composting projects are only feasible through the revenues of the carbon credit sales which allow the local partners to make the compost available at attractive prices for a broader market in the project countries.

The application of compost not only helps to bring back soil fertility and the overall balance of ecosystems, but also constitutes an alternative to environmentally harmful chemical fertilizers. Using compost leads to decreased dependency of farmers on international fertilizer suppliers. It also helps to increase and stabilize yields, save water, sequester carbon and generate a stable income for farmers of the developing world. Thus, Soil & More focuses as well on job security and creation. Given that the agricultural sector re-

One of the model projects in Egypt: more than 500 hectares of hostile desert have been turned into fertile soil within 18 months, using compost.
remains one of the biggest employers worldwide, a sustainable, compost based agricultural system securing the productivity of agricultural production units helps to prevent mass migration from rural areas to the urban centers.

**Carbon Footprinting; Water Footprinting; Sustainability Footprinting**

End of 2007, Soil & More started standardizing carbon footprinting methodologies, which were subsequently implemented on several agricultural supply chains (such as apples, pears, bananas, beans, citrus, cotton flowers, fresh and dry herbs, grapes, peppers, potatoes, strawberries, tomatoes and others), and are marketed and promoted through companies and brands like AlnaturA, Dole, Dovex, EOSTA, IFOAM, Lebensbaum, Ritter Sport, Sekem, Weleda and others. Ever since, Soil & More helps companies to identify and understand their greenhouse gas emissions and their sustainability risks by carrying out carbon footprint assessments according to the latest internationally recognized standards and guidelines (ISO, WRI/WBCSD, PAS2050, TÜV-Nord). Such a carbon footprint helps to collect information needed to reduce greenhouse gas emissions, identify cost saving opportunities and develop a strategy to lower a company’s sustainability risk. Upon request, these footprints can be certified by an independent third party. Once emissions have been determined and reduced, it is possible to neutralize them through the purchase of carbon credits. A climate neutral entity or unit (e.g., a company, a product) is one of the first tools for organic and biodynamic growers, to prove on a fact basis their environmental competitiveness that can be capitalized on for marketing purposes to create competitive advantage in the market. Soil & More is one of the first companies specialized in the organic agricultural sector to offer independently certified carbon footprints of agricultural products, neutralized with carbon credits obtained from organic farming practices. This means a sector internal solution, capitalizing on the competitiveness of the organic agricultural sector. Recently, Soil & More has joined the Water Footprint Network, becoming an accredited service provider for water footprinting.

Soil & More’s ultimate goal, however, is to develop a comprehensive sustainability footprinting tool, which goes beyond CO₂e and water, and includes other sustainability indicators such as energy, air, animals, plants, and soil. In cooperation with scientists and its global partners, Soil & More aims to develop methods and standards that can be used to carry out a holistic sustainability footprint assessment, thus enabling companies to measure and improve their economic, environmental and social performance towards a meaningful footprint. In times of rapidly increasing population and shrinking resources, it is not enough to sustain these resources. They need to be developed continuously. Professionally managed, sustainable organic agricultural systems have a clear competitive advantage to carry out this task, which ultimately means feeding the world.

**Research & Development**

In order to maintain and further develop its innovative products and services, Soil & More co-
operates with various pioneer companies from the organic movement, as well as leading research institutes (e.g., Louis Bolk Institute, FIBL, Heliopolis Academy) dedicated to the topic of soil science, composting, emission reduction, sustainability and footprinting.

In cooperation with the Dutch Louis Bolk Institute, Soil & More experts recently carried out a study on carbon sequestration and storage in organically managed soils on reclaimed desert farms in Egypt; (the research report is published on Soil & More’s website, and a short case study can be found in IFOAM’s publication, “The Contribution of Organic Agriculture to Climate Change Adaptation in Africa.”) It was concluded that, due to regular compost application, the carbon stocks in the assessed soils had accumulated more than 26 tonnes of carbon per hectare over a period of 30 years (see Figure 1). During the first five years in particular, a rapid increase of carbon stocks was discovered, a finding in line with studies previously carried out. This small scale research project confirms assumptions made by most of the leading climate change institutions that classify “sustainable” soil management as a major solution to mitigating climate change. Currently, this pilot trial is being scaled up towards more farms, also incorporating other research questions, such as the impact of regular compost application on the soils’ water holding capacity. The goal is to compare the development of carbon stocks and the water holding capacity of organically managed soils with that of their conventional counterparts.

Cooperation with IFOAM
Soil & More’s values are in line with the ones of IFOAM. Both organizations support a sustainable environment, and promote healthy soils and thereby help towards providing healthy products for healthy people. Therefore, the Soil & More...
At the end of October 2009, an EU project in the project-line of Leonardo-da-Vinci focusing on Organic Retail Competence was finalised. A quality assurance system known as the ECO QUALIFY 2 (EQ) project, focusing on advanced training in the organic retailing business for European institutes of adult education and their trainers, was developed and disseminated.

A comprehensive *EQ-Quality-Handbook* has been published and is available for the public. The new quality-assurance-system will standardise and upgrade the level and structure of further vocational training for the organic retailing-sector in Europe.

ECO QUALIFY 2 builds on the existing results of ECO QUALIFY 1: the *Qualification Standards for Organic Retailers*. These standards serve as a guideline for the qualification of staff and executives in the retailing of organic products and have been integrated into numerous vocational-training-concepts and curricula.

Partners involved in the project come from Austria, Czech Republic, Germany, Holland and Italy. Over 2 years experts from these NGOs have adopted this wide theme, developing and disseminating an easy to apply quality-assurance-system. The system has been tested in practice and adapted to the daily routine in adult education and training.

In confirmation of the potential importance of the ECO-QUALIFY Quality Assurance System several educational institutions have expressed interest in receiving certification in accordance with ECO QUALIFY. Amongst these is the renowned Institute for Adult Education, *Forum Berufsbildung in Berlin*, as well as the *Hamburg based Ökomarkt-Institute*, *SPES Academy of Austria*, and *Warmonderhof* of Holland – more to follow.

The certification is the responsibility of ORA, the Vienna-based International Organic Retailers Association which is an Internal Body for Retailing issues within IFOAM. ORA also is entrusted with the administration and dissemination of the whole ECO QUALIFY System.

**Further information:** [www.o-r-a.org](http://www.o-r-a.org)

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By Edith Lammerts van Bueren
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When it comes to discussions on genetically modified organisms (GMOs) and organic agriculture, biotechnologists often ask: “Why are your rules so strict? Why ban GMOs when they are the only tool to secure the world’s future need for food? They are more efficient, quicker, etc!” When asked these questions I explain the underlying values of organic agriculture. In this article I will discuss the basic values of organic agriculture as laid down in the IFOAM four basic principles (see Figure 1), and will relate them to the field of plant breeding. I also discuss the consequences and challenges for the further development of organic plant breeding.

Normative values
In 2004 Hugo Alrøe from DARCOF, Denmark, described three perspectives within the organic movement.

1. Values. Organic agriculture is founded on concerns about soil fertility and the belief that the living soil is a basis for a healthy plant and farming system. Such values initiated the development of an organic movement. The recent reformulation of the IFOAM principles of health, ecology, fairness and care (see www.ifoam.org) show that organic agriculture is still value driven from “inside” the movement.

2. Protest against conventional agriculture. In the 1970s more and more people supported organic agriculture as a protest against conventional agriculture. They were driven by political issues such as environmental pollution and chemical residues. The driving force came more from the “outside”, but was closely connected to the values from “inside” the organic movement.

3. Niche market. Since the 1990s the organic sector has further grown as conventional traders discovered that organic products were an valuable niche market. The driving force behind this type of development was triggered by economic factors, working as an “outside” motive for further development.

Nowadays organic agriculture is a result of an interaction between the three perspectives. The standards for organic agriculture are an expression of the current underlying values and serve to justify the sector’s arguments against undesirable developments, while giving guidance on the desirability of new developments.

Product or process based values?
The values of organic agriculture and, therefore, its norms and standards are process orientated rather than product orientated. That is, they are based on the process of farming and not specifically on the product. A farmer, for example, receives certification because his farm management conforms to the standards and not because his products achieve a certain level of quality.
This difference between product and process-based focus causes confusion in the public discussion of GMOs. In a discussion people may speak from different standpoints, focussing either on the product or the process of genetic engineering. Those who are product orientated are only concerned with the effects a new technique or product may have on issues like health or the environment. For them, the methods or processes is unimportant. Others who are very critical about genetic engineering regard the process of forcing foreign genes into the genome of a living organism as a violation to the integrity of life.

Interestingly, the European regulation on GMOs is based on both process and product. This means that oil derived from genetically modified soybeans is considered a GMO even though it contains no modified DNA (only protein contains modified DNA). This is in contrast to the USA where the regulation is purely product based, and the oil is not considered as a GMO.

**Integrity of Life**

The European attitude towards GMOs reflects a shift in society to considering not only humans and sentient animals as ethically relevant but all living entities including plants. This view considers autonomy and dignity as intrinsic values of all living beings. The interpretation of intrinsic value depends on the relationship with nature. Considering plants merely as a set of genes that can be changed according the preference of mankind, makes a farce of the idea of integrity of plants. Organic agriculture does not support such a biocentric framework of action, it acknowledges the integrity of humans, animals and plants. It also means that this value system should be taken into account when making decisions on farming systems, and also in breeding policies.

Integrity of life refers to an organism’s inherent nature, its species specific characteristics and the balance it maintains with its natural (or, in the case of cultivated plants, to its organically farmed) environment. This respect for the integrity of life does not imply that interference in nature is prohibited in organic farming; interference is allowed but not at all costs. Organic farm management aims at producing food for mankind, but in such a way that one cooperates with life and not by overruling or bypassing it.

**The consequences of the IFOAM principles for plant breeding**

As plant breeding and seed production are part of organic agriculture, the respect for life will also influence the way that the breeding process is approached. This ethical attitude is reflected in the IFOAM principles of health, ecology, fairness and care, (see Figure 1).

![Figure 1: The four IFOAM principles (see www.ifoam.org)](image-url)
**The principle of health** means that organic plant breeding serves the wholeness and integrity of living systems by supporting their immunity, resilience, regeneration and sustainability. This implies that there is a need for robust and dynamic varieties that suppress weeds, tolerate disease and interact with beneficial soil organisms, such as mycorrhiza. Such a systems approach requires varieties that can be reproduced by farmers and are not male sterile.

**The principle of ecology** leads to the optimal functioning of a diverse range of ecological production systems appropriate for specific sites. This would imply breeding for regional adaptability through decentralised (regional) and participatory breeding programs, promoting genetic diversity as a tool for sustainability. Using ecological principles implies that breeding can take a multi-level approach to disease resistance, including the breeding for morphological or physiological traits that contribute to the robustness of a plant. For example, a cabbage variety can gain resistance to insects such as thrips by having a slightly thicker wax layer on the leaves, and wheat can overcome certain ear diseases when the haulm length is longer thus raising the ear above the moist leaf canopy where it is drier due to exposure to the wind and sun.

**The principle of fairness** applied in breeding aims at serving equity, respect, justice and stewardship of the shared world. This would imply free access to genetic resources, while prohibiting patents on life. It would also require equal sharing of the benefits when varieties have been bred in cooperation between commercial breeding companies and farmers.

**The principle of care** applied in organic plant breeding should enhance efficiency and productivity in a precautionary and responsible manner. This is one of the reasons why organic agriculture refrains from the use of GMOs and related techniques such as cell fusion techniques.

**Future**

The question then arises: does refusing GMOs mean that organic agriculture will be cut off from future developments? My answer is: no. But we will have to deal with challenges as we have done before when we decided to refrain from using mineral fertilizers and had to learn how to compost and use organic fertilizers to build up a living soil with a good level of soil fertility. We also dealt with the challenge of not using chemical herbicides and pesticides. We had to learn how to enhance and manage biodiversity to build up agro-eco resilience. Meeting the challenges posed by genetic engineering is no different; we will learn how to breed for adaptive, flexible and nutritious varieties to build up plant robustness combined with food quality.

It is important that we clearly communicate our values concerning organic agriculture. In particular we must be more explicit in how we communicate our breeding goals. For example take the organic principles:

- When following the principle of health, the challenge is to respect plant integrity as part of the whole agricultural ecosystem, which means, for example, that improving wheat does not only include the yield, but also the length of the stem for straw and the expansion of the root system so it is able to exploit a larger volume of soil.
• With respect to the principle of ecology the challenge is to develop multilevel approaches in breeding. A crop that is able to cover the soil quickly may not only be capable of growing under low-input conditions but would also be more weed suppressive.

• The principle of fairness is also important since breeding includes not only a technical activity but also a social-economic construction. Economic constraints encountered by commercial seed producers are steering the development of the varieties. For example, varieties are made male sterile so that competitor breeders are not able to use them in their own breeding programs, while crops are bred as F1 hybrids so that farmers will have to buy new seed every year. Likewise, Monsanto’s production of terminator seeds in which the seed can produce a crop but will not produce seed that will grow into the second generation. Commercial breeding is organized in such a way that it is only profitable when seed sales are large enough. This means that breeding for niche markets such as organic is not commercially viable. New social-economic structures such as co-operations between farmers, traders and breeders should be designed to enable breeding for such markets. Participatory breeding can be an integral part of this new model in which farmers do part of the selection. They would then be recognised and rewarded for their efforts.

We can conclude that we have many reasons to apply the precautionary principle of care by refraining from using GMOs. There are enough alternatives to improve crops, and there is plenty of unexplored indigenous knowledge to initiate new multifaceted breeding strategies. In such a way the IFOAM principles can be translated into the field of plant breeding.

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Lammerts van Bueren, E.T., Struik, P.C., Tiemens-Hulscher, M. and Jacobsen, E. 2003. The concepts of intrinsic value and integrity of plants in organic plant breeding and propagation, 43: 1922-1929. (This paper can be sent by the author on request.)
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Introduction
Since the 1960s plant breeding has concentrated on producing high-input cultivars suited to a broad adaptation. This strategy has increased production in many areas but it has also had a negative social, environmental and genetic impact on the world’s farming community. For example, 75% of plant genetic diversity has been lost, as farmers have abandoned their local varieties for higher yielding, genetically uniform types (UN 2009). Likewise, the knowledge related to these varieties has also disappeared, further threatening the maintenance of plant biodiversity (de Boef 1993). The diffusion of high-input varieties has excluded small-scale farmers, many of whom grow on marginal lands, from the benefits of these varieties since using them often requires costly inputs that farmers cannot afford.

Climate change and the increasing unsustainability of small-scale farming in the face of growing poverty and malnourishment have highlighted the need to focus on agricultural development for marginal environments, which is where the majority of the rural poor live (Altieri and Koohafkan 2008). Small-scale farmers from marginal areas are likely to be the first affected by climate change. In areas where plant survival is already at its limit, worsening environmental conditions could make agriculture impossible. Evidence suggests that when agriculture becomes a risky or economically unsustainable activity men are forced to look for off-farm paid work and women get increasingly involved in the agricultural work. Climate unpredictability, therefore, is likely to accentuate a feminization of agricultural labour in marginal areas, making women the main users of agricultural technology.

Organic plant breeding (OPB) offers a novel approach to technology development in agriculture. It also argues for the inclusion of farmers in seed improvement on the basis of increased equity, efficiency and effectiveness. The importance of a gender dimension in organic breeding is supported by the organic agriculture principles of fairness, health, ecology and care. Moreover, a focus on women is especially important in OPB because women farmers have special roles and needs in organic agriculture as compared to conventional agriculture.

Organic plant breeding, gender and women
Organic plant breeding emphasises agricultural practices as site-specific and culturally embedded. Therefore, participatory strategies and gender-sensitive approaches encourage the inclusion of all stakeholders and the use of their local knowledge in seed improvement. Gender approaches are particularly appropriate to organic breeding since the principles of fairness, care and effectiveness entail a focus on most marginal and poor areas of the world, and on the poorest, most margin-
alized households and individuals in these areas. In addition, a gender approach can facilitate the inclusion of all these stakeholders across both geographical and social barriers.

Women play a pivotal role in meeting the principles of the OPB, as embedded in the principles of organic agriculture. For example, according to the ‘Principle of Fairness’ organic agriculture should contribute to food sovereignty1 and poverty reduction (Luttikholt 2007). Thus, as it is the women who are generally in charge of the household’s food security (Farnworth and Hutchings 2009), their role in upholding this principle is crucial. Their role as food producers is also central to the ‘Principle of Health’, which emphasizes the importance of producing high quality and nutritious food.

The ‘Principle of Ecology’ refers to the need of adapting organic agriculture management to local conditions, ecology, culture, and of involving those who produce, process, trade and consume. Women farmers are involved in the most labour-intensive activities throughout the food-production chain; from seed storing right through to processing. Thus, women’s engagement in the food-production chain covers the whole farm-ecosystem and its sustainability rather than focusing on just productivity, thereby supporting the holistic approach of organic agriculture (Lammerts van Bueren et al 2002).

The ‘Principle of Care’ recognises the importance of practical experience, accumulated wisdom, and indigenous and traditional knowledge in technology development. Since men and women might have different perspectives on the varieties of plants they grow (Farnworth and Jiggins 2003; Howard 2003) it is necessary to adopt gender-sensitive measures in organic plant breeding.

Finally, the involvement of women farmers in organic plant breeding is particularly important because they have special roles and needs within organic agriculture. For example, they are much more likely than men to operate small scale farms. Women farmers also have a central role in weed, pest and disease management that are central activities distinguishing OPB from conventional plant breeding.

Policy implications
Increasing food availability will not reduce hunger unless accessibility (UN 2009a) and the policies that regulate distribution of food, productive resources and opportunities are also improved.

The participation of farmers in breeding activities raises institutional and policy issues concerned with how farmers’ knowledge is valued. Currently, international and national regulations limit farmers’ rights and opportunities to access improved seed, with a consequent decline in the security of their livelihoods. This legal framework is particularly problematic in cases where farmers who, through participatory breeding programs, have collaborated in the production of genetic material and, therefore, have claims that are equal to the breeders’ rights (PRGA 2009).

The adoption of a gender-sensitive approach in organic plant breeding raises further concerns regarding the rights of male and female farmers to the genetic material they co-produce. In fact, a gender-blind approach to these rights might result in the discrimination of women regarding access to, control and ownership of natural resources (see CEDAW 2004).

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1 The right of peoples to decide on their own food systems and food values, and the right to produce their own food (Luttikholt 2007: 352)
International recommendations and the reality on the ground

International frameworks have underlined the necessity and stressed the urgency of bringing women into the mainstream as key actors in the entire farm-to-fork value chain. The reasons they give for this include social equity and increasing the effectiveness of development agendas (Convention on Biological Diversity; FAO, WB and IFAD 2009).

The Millennium Development Goals (MDGs) promote gender equality and the empowerment of women. The International Assessment of Agricultural Knowledge, Science and Technology Development (2009) highlights the need to effectively involve women in agricultural knowledge, science and technology, and to use their knowledge, skills and experience to advance progress towards sustainability and development goals.

However, despite these recommendations, agricultural development rarely acknowledges small-scale farmers, and women in particular, as informal plant breeders and natural resource managers (FAO, WB and IFAD 2009). At the policy level, international governance systems often rely on national governments to formulate legislation and implement policies that are adjusted to the local context. This often means adopting national cultural norms that reflect already existing social structures that include gender biases.

In Syria, it is estimated that the work done by women in agriculture amounts to 70% of all agricultural activities in the country (Soubh 2006: ii). This effort is paralleled by a growing feminization of agricultural labour (Abdel-Ali Martini et al 2003). Despite their consistent and increasing involvement in agriculture, however, women are not considered – and do not consider themselves – as farmers in their own right but rather as ‘helpers’. Their work is viewed as non-essential and auxiliary to that of the men at the household, community and national level. Men, on the other hand, are often assumed to be the sole breadwinners in the household and are, thus, considered more rightfully entitled to property, wages and natural resources.

The assumption that farming is a male activity and women are only helpers is also reported elsewhere, such as in North America, Europe and Latin America (Farnworth and Hutchings 2009). This false perception of women being characterised as mainly “domestic workers” is incorporated as “hard” data into surveys that are then used in the formulation of agrarian policies and development interventions (see El-Fattal 1996). Since men are assumed to be the farmers they have become the sole addressees of agricultural technology such as plant breeding and women have generally been excluded from participation in agricultural development and natural resource management (WB 2007). A report by the FAO, WB and IFAD (2009) shows that women are disadvantaged in sharing benefits from natural resources and genetic material. As a consequence, agricultural technology has been less effective in producing seed appropriate to the local needs, and, therefore, in enhancing rural livelihoods. Moreover, the benefits of agricultural technologies have been unevenly distributed.

Conclusion

A gender-balanced organic plant breeding (OPB) program has the potential to enhance food security and health. It could do so by producing, in collaboration with male and female farmers, better adapted crops that reflect the needs, priorities and expertise of all stakeholders. By providing all farmers with secure access to appropriate seed
and the related information, OPB can support the amelioration of crop cultivation. By paying attention to farmers’ crop preferences OPB can support often overlooked crops that are fundamental to the livelihoods of many communities.

In addition, a gender-balanced OPB can provide better responses to climate change through increased biodiversity because of attention paid to more crops, more varieties and more traits. By collaborating with female farmers OPB addresses a group of agricultural technology users that is likely to grow as a result of unpredictable climatic condition and increasingly unreliable agricultural production.

Finally, a gender-sensitive OPB can enhance fair development and increase social and gender justice. OPB could represent an opportunity to women and men alike to produce seed appropriate to their needs and take decisions about what crops to grow, use and eat. It could create a mechanism to secure access to the seed and the related information. It can also provide an institutional channel to support women’s otherwise limited control of the revenues generated by their work and the seed. Ultimately, OPB can empower the farmers by making them collaborators in research, thus increasing their control over agricultural technology and reducing their dependency on seed and inputs that are produced in laboratories.

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Indigenous Breeds can Improve Sustainability of Organic Livestock Production Systems – an Indian Perspective

By Mahesh Chander¹ and B. Subrahmanyeswari²

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The preamble
Indigenous breeds of livestock are well adapted to their environments. This adaptability has been developed over the course of history by pastoralists and small-scale farmers who have managed and selected their livestock, exposing them to different environments and using – and thus, shaping – them to suit their resource endowments. As such, these breeds are an integral part of the culture and livelihoods of small-scale farmers in developing economies like India. In contrast, breeds used in large-scale, input intensive production systems aimed at a rapid increase in production, and promoted worldwide, have put these indigenous breeds and their owners’ livelihoods at risk. Globalization, environmental degradation, climate change, changes in land use, and many other factors have all threatened the traditional systems; a loss that might endanger food security in marginal areas. According to FAO, over the last several decades, the world has lost about 700 of the some 7,600 reported breeds, and many of the remaining breeds are endangered. Factors behind the loss include the intensification and globalization of livestock production, and adverse policies that disadvantage pastoralists, small-scale farmers and other marginalized livestock keepers. Under these circumstances, given its principles, practices and well considered standards, organic farming offers a ray of hope for the revival of diminishing indigenous breeds. Organic farming ranks the importance of local breeds and resources much higher than that of hybrids and external inputs. This paper highlights the importance of these breeds in context of organic livestock production, taking India as a case study.

Introduction
The guidelines for organic livestock production emphasize the importance of using breeds suited to the region and the production method, and of allowing them to breed under natural conditions and without routine human involvement. Thus, in principle, organic farming encourages the use of local and native breeds. Good animal welfare on the farm starts with the farmer choosing a breed that has a low incidence of genetically determined welfare problems. Use of a suitable breed enhances animal welfare on a farm, and on-farm selection for characteristics that best fit the local farm production conditions is a positive step that can be taken by the farmer. To this end, indigenous livestock and poultry breeds, which are ideal for organic production systems, deserve attention in preference to the exotic or crossbred types.

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To rapidly boost agricultural production, hybrid plant varieties in cereal crops and exotic or crossbred livestock were introduced into India in the 1960s. This approach ignored the potential of native varieties and breeds under the exigency of food scarcity conditions prevailing in those days. Crossbreeding involving exotic breeds still remains an important policy intervention for livestock improvement in India with substantial financial allocation for this purpose. In contrast, Sir Arthur Oliver, the then Animal Husbandry expert to the Government of India, appointed by the Royal Commission on Agriculture, saw a tremendous potential in Indian cattle breeds as early as the 1930s. He observed that if cows of the best indigenous breeds are systematically improved with proper care and strict selection, their potential can be raised to levels of milk production that even exceed those of good dairy herds of European cattle. The Indian Council of Agriculture Research (ICAR), on the basis of suggestions by Goseva Sangh (1949), also recommended that the milk production of well-defined indigenous breeds of cattle should be improved by selective breeding. Such observations have become more widespread, and there has been increasing recognition within organic farming in India, that the importance of indigenous breeds is likely to increase. Moreover, dairy products and the dung or even urine of indigenous cows is valued more than the products of exotic or crossbred cows in India. Therefore, future work on developing sustainable livestock production systems suitable to Indian conditions, must focus more on the local livestock resources available in India.

**Breeds and Breeding**

In addition to production record, livestock display several other characteristics that are equally important for adaptation to an organic environment. These include features such as mothering ability, hardiness and thriftiness, resistance to disease and parasites, and ability to forage. The breeding goals of conventional farming systems, which have been exclusively directed towards increased

In India bulls of native cattle breeds are valued highly in local cattle markets since crossbreds are less efficient in agri operations. (Photo: M Chander)
production efficiency, have most often resulted in animals that do not profit from welfare friendly housing conditions and management procedures. For instance, high milk yield in cows is often associated with an increased incidence of production diseases like mastitis. Organic farmers are more likely to maintain livestock for their lifetime yield and longevity. Studies show that heifers, selected for high first lactation yields and bred early, often have inferior production after the second lactation when compared to later maturing cows. Selection by the farmers for useful traits is also a viable option for some genetically determined characteristics. Resistance to parasites is one example. Indian native cattle suffer less from tick infestations when compared with exotic or crossbreds. Likewise, local cows show high resistance to diseases like foot and mouth (FMD), as was observed during a recent outbreak in a cattle farm run by the Indian Veterinary Research Institute, where Tharparkar breed cattle had least incidence and morbidity, compared to crossbreds.

**Role of native cattle**

The health care requirements of Indian native cattle and buffaloes are some of the lowest in the world, owing to their high disease resistance. Health signifies the most important sign of successful organic animal husbandry and all other aspects such as profit, fertility, growth rate, milk yield and feed conversion are related to the animal’s health. In addition, in India a substantial number of bullocks of indigenous breeds are used for plowing agricultural land, while the crossbred bulls or exotic breeds perform poorly as draught animals. In spite of the large scale application of tractors and electrical power in agriculture, animal power still plays an important role in India. The value of the work conducted by draught animals in India is estimated to be about 20 billion US$ per annum. In contrast, mechanical sources of agricultural power depend on fossil fuel, which has only a limited self life that is fast depleting. These facts support the view that, given the high adaptability of Indian cattle and the extra resourc-
es they offer Indian farmers, local cattle are best suited to Indian agriculture. The so-called higher yielders with an exotic inheritance, require more feed, fodder and other maintenance costs. Yet, despite this the population of recognized native livestock breeds is on the decline in India (Table 1).

Animal Breeding in Ancient India
The traditional approach to breed improvement in India was aimed at meeting the requirements of local communities with due consideration to local resources. Through these practices, fine breeds of livestock, particularly cattle and horses, evolved throughout the country. These breeds were also sought out in other countries due to their special characteristic of disease resistance. These unique livestock breeds were used by Indian farmers for multiple purposes such as draught, and milk production. For example, cattle breeds like Amritmahal, Hallikar, Khillar and Ongole, are excellent draught or dual purpose breeds. The ancient people were also very careful at maintaining specific characteristics of the breeds by following controlled breeding system. There is evidence to suggest that breed improvement was never conducted in isolation but always linked to housing, nutrition and hygiene.

Indigenous cattle in organic farming
The biodiversity of cattle in India is unparalleled in the world, encompassing a wide spectrum of breeds of indigenous breeds that are elaborately allied with social, cultural and traditional values of the diversified geographical areas of the country and its inhabitants. In the recent past, when the breeding emphasis shifted from the total contributions of cows to just milk production, indigenous cattle, with their low milk productivity, became marginalized. However, crossbreeding indigenous cattle with exotic cattle has not found much favor with farmers due to the associated problems of health, reproductive failures, nutrition and other sophisticated requirements. This is evident from the fact that despite sustained cross breeding efforts since 1960s, the crossbred cattle population has remained below 15% in India with huge regional imbalances. As a consequence, emphasis has again shifted towards indigenous cattle breeds, with the belief that they have not yet been exploited to their full potential. Organic livestock farming may further revive interest in indigenous breeds leading to the further improvement and conservation of local breeds.

Despite the attention on crossbreeding, indigenous cattle still contribute immensely to the economy of India, through milk, draught, urine, dung, bones, hides, horns etc. These breeds of cattle are

<table>
<thead>
<tr>
<th>Species</th>
<th>Breeds</th>
</tr>
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<tbody>
<tr>
<td>Cattle</td>
<td>Vechur, Punganur, Red Sindhi, Sahiwal, Krishna Valley, Amritmahal, Hariana, Nagouri</td>
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<tr>
<td>Buffalo</td>
<td>Wild Asiatic buffalo, Toda, Bhadawari, Nili-Ravi</td>
</tr>
<tr>
<td>Sheep</td>
<td>Karnah, Gurej, Poonchi, Bhakarwal, Nilgiri, Pugal, Changthangi, Chokla, Hisardale</td>
</tr>
<tr>
<td>Goat</td>
<td>Jamunapari, Beetal, Surti, Changthangi</td>
</tr>
<tr>
<td>Horses</td>
<td>Zanskari, Spiti, Marwari, Kathiawari, Bhutia</td>
</tr>
<tr>
<td>Camel</td>
<td>Double hump camel, Jaisalmeri</td>
</tr>
<tr>
<td>Poultry</td>
<td>All native breeds except Aseel and Kadaknath</td>
</tr>
</tbody>
</table>

Table 1: Indian breeds showing declining trends
the result of thousands of years of selection, evolution and development in the process of domestication suitable to the local agro-climatic conditions. Milch breeds like Sahiwal, Red Sindhi, Gir and Rathi are high milk producers, while the majority of other cattle breeds belong to the draught or dual purpose categories providing small/good amounts of milk in addition to quality bullocks for draught and other purposes in agriculture. These native breeds exhibit a distinct superiority in utilizing poor quality feed and are adapted to withstand heat and show better resistance to tropical diseases. The advantages of exotic breeds or crossbreds are seen only in a few regional pockets with favorable conditions like irrigation. Vast areas of rural India still depend on indigenous cattle for milk, manure and draught. Even where crossbreds are prominent, bullocks of indigenous breeds are still used for carting and plowing. A scarcity of water and feed resources is very common in the vast tract of India, particularly the dry land/rain fed regions. Productivity in relation to water availability of the indigenous breed is much higher than that of any exotic breed. Hence, in the light of the organic movement there is a strong case for adopting and propagating indigenous breeds.

There is no question that in favorable environments crossbreds are better milk producers than indigenous breeds. However, their tendency to under perform under the harsh Indian conditions of low input and extreme climate, as well as their susceptibility to tropical diseases warrants the conservation of indigenous breeds. Therefore, an organized effort is required to improve the genetic potential of these breeds. The marked decline in the number of elite producers in Indian dairy breeds like Sahiwal, Red Sindhi, Tharparkar, Gir can be checked if their potential is suitably harnessed in organic livestock production.

Conclusion

Indigenous breeds perform well and are fully adapted to their local environment, thus, these should be the breeds of choice under organic livestock production. Tropical countries like India are well endowed in terms of breed diversity. It is clear that organic production and indigenous breeds are complimentary to each other, and this natural advantage needs to be suitably channeled into organic livestock production.
Introduction

Cell fusion is a breeding technique included within the EU, NOP, Demeter and IFOAM definitions of genetic engineering. This means that it should not be used in organic plant breeding and seed originated from it have no place in organic farming. Many organic farmers and breeders agree with this stance, and that cell fusion techniques are not indispensable for plant breeding.

However, since cell fusion techniques are excluded from the scope of the European Regulation on GMOs (2001/18/EC), varieties made with these techniques are not labelled. Therefore, they are not recognizable to farmers as being a GMO, and as a consequence are, in fact, widely used by organic farmers. This makes it difficult to implement a ban.

During the IFOAM General Assembly in Modena, in 2008, a motion was accepted that states “cell fusion, including protoplast and cytoplast fusion, do not comply with the principles of organic agriculture”. Therefore, the IFOAM World Board was urged to develop clear guidelines on how to deal with varieties derived from those techniques.

This paper gives an insight into the discussion on cell fusion techniques and the steps that are necessary to implement the IFOAM motion.

Why are cell fusion techniques used?

Cell fusion techniques are used to transfer Cytoplasmatic Male Sterility (CMS) in brassica (cabbage, cauliflower, broccoli, kohlrabi, etc.) and chicory breeding. It was found that CMS hybrids display an increased uniformity. Nowadays, high uniformity of varieties and crops is an important breeding goal. Homogenous varieties and crops are especially desirable as they facilitate the use of machinery, are better suited for packing and meet consumers’ demands.

However, it should be noted that uniformity in CMS hybrids is only very slightly higher than in CMS-free plants. The differences are not easily seen, and are only apparent in a direct comparison of the crops.

Plants that carry the CMS trait have sterile male flowering organs. The sterility is a result of cytoplasmic traits, or more precisely, due to mitochondrial genes. CMS can occur naturally in some plant species, like for example sunflowers. In wild plant populations, the natural occurrence...
of CMS is assumed to enhance genetic variability as well as genetic exchange and to avoid inbreeding depression. But CMS can also be introduced artificially by cell fusion techniques.

The first step in the technique (Figure 1) is to use enzymes to remove the cell walls from the acceptor cells, thus, creating “protoplasts” (cells without a cell wall). In a second step, the core of the donor cell (the CMS cell) is chemically destroyed, resulting in a cytoplast containing the mitochondria that carry the CMS genes. The third step is the actual cell fusion: electric impulses stimulate the acceptor protoplast to fuse with the donor cytoplast; the result is a CMS cell of a formerly CMS-free species. This cell can be recultivated into a whole male sterile plant.

How did cell fusion techniques enter the organic sector?
Although the EU definition of GMOs includes cell fusion techniques, Directive 2001/18/EC makes an important exemption: cell fusion is excluded from the scope of the Directive when it is a fusion “of plant cells of organisms which can exchange genetic material through traditional breeding methods”.

The European Commission interpreted this exemption to cover a very broad definition of “traditional breeding methods”. According to this interpretation the fusion of plant cells of organisms within the same botanical family is considered to be “traditional breeding”, even if those species – for instance, radish and cabbage – cannot exchange genetic material by natural recombination. Therefore, under the Directive cell fusion of such species is not considered to be a technique of genetic modification.

The practical implementation of this means that all existing forms of cell fusion are excluded from the European GMO Regulation. Therefore, breeders do not need a license to use these techniques and varieties originated from it are not labelled as “GMOs”. This makes it hard for organic growers to identify and avoid these varieties.

The second problem originates from the first: as varieties bred with cell fusion techniques are legally not a GMO, the EU Regulation on organic farming (EC 834/2007) does not restrict their use in organic farming. So the use of those varieties in organic farming is in line with the public legal provisions. As a consequence CMS hybrids, especially brassica varieties, are now widely used by organic farmers.

Why is a ban necessary?
There are several reasons why CMS hybrids should be banned from organic farming. First, cell fusion is, scientifically speaking, a technique of genetic engineering and genetic engineering is incompatible with the principles of organic farming.

Another objection against this technique is the patent registration of CMS-systems. As the pro-
The production of engineered CMS hybrids is a highly skillful technique, requiring considerable laboratory background, most CMS-systems and varieties are patent-registered.

Although there is currently no official IFOAM position on the use of patents it is likely that there will be soon**. In any case, the organic sector is, in general, against patents on life forms because it is unethical and because it limits further breeding and recultivation. Indeed, since CMS-hybrids are male-sterile they cannot be used for further breeding at all.

If the organic sector accepts the use of varieties made by cell fusion techniques for pragmatic reasons – they are already widely used and they provide better varieties – the organic sector could lose credibility and consumer confidence. And finally, such an acceptance would make it more difficult to ban on principle any new GE breeding techniques, like reverse breeding.

**This will be part of the position on seeds that is currently in development.

### Strategy

To implement the IFOAM motion and “develop clear guidelines on how to deal with varieties derived from cell fusion techniques in organic farming” several workshops have been organized.

In April 2009 a group of European stakeholder experts met in Paris for an Eco-PB/ITAB workshop on this subject. The outcome of this workshop was a declaration with recommendations, tools and a time frame for the ban from organic farming of all crop varieties made through cell fusion techniques. In this declaration three main goals were set:

1. Develop and maintain (in the market) varieties that are suitable for and compatible with organic farming, e.g. CMS free varieties.

2. Get and keep organic seeds free from cell fusion techniques.

3. Forbid the use of cell fusion varieties in organic farming.
To achieve an official ban on the use of cell fusion varieties (goal 3) it was recommended, in the short term, to concentrate on private standards (IFOAM, Demeter, Bioland etc) and private agreements by traders (Carrefour, etc.), farmers and policy organizations. In the long term it was agreed a ban should be implemented in public law to create a level playing field for all organic producers.

An important tool in the implementation of a ban is a list of varieties that are made by cell fusion techniques. In Europe, private organizations like Demeter, Bioland, Naturland, BioBreizh have already forbidden their farmers to use CMS varieties. They use so-called “negative lists” (Table 1) to make sure that growers comply with the standards. In Paris Eco-PB promised to compile and publish a European list every year.

In August 2009, at the IFOAM conference on organic breeding in Santa Fe, USA, the issue of cell fusion techniques was again discussed in a special workshop. The aim was to broaden the discussion from Europe to the rest of the world.

At this workshop it became clear that the use of cell fusion techniques is not yet a big issue outside Europe. In the United States, for example, the problem of contamination of organic seeds by transgenic plants like canola is more pressing, and consuming all attention in the national genetic engineering debate. The US expert that took part in the debate made it clear that there is support for the European position but that they need time to raise awareness. One important step in the USA will be to identify CMS varieties that are actually on the market.

**References**


<table>
<thead>
<tr>
<th>Crop</th>
<th>Number of CMS varieties available on the market</th>
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<tbody>
<tr>
<td></td>
<td>France</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>173</td>
</tr>
<tr>
<td>(white &amp; coloured)</td>
<td></td>
</tr>
<tr>
<td>Green cabbage</td>
<td>51</td>
</tr>
<tr>
<td>Savoy cabbage</td>
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<tr>
<td>Kohlrabi</td>
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</tr>
<tr>
<td>Broccoli</td>
<td>11</td>
</tr>
<tr>
<td>Red cabbage</td>
<td>11</td>
</tr>
<tr>
<td>Brussels sprouts</td>
<td>7</td>
</tr>
<tr>
<td>Romanesco</td>
<td>9</td>
</tr>
<tr>
<td>Chinese cabbage</td>
<td>–</td>
</tr>
<tr>
<td>Pointed cabbage</td>
<td>3</td>
</tr>
<tr>
<td>Chicory</td>
<td>8</td>
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</table>

Table 1: Number of CMS varieties listed in the French (Rey, 2008) and German (Regnat, 2008) negative lists in 2008.
Modified Bulk Selection Method of Breeding Rice for Broader Genetic Diversity

Introduction
Almost two decades after the introduction of modern industrialized chemical farming in the Philippines, via the Green Revolution technologies, the unsustainability of the, so-called, miracle high yielding rice varieties has become apparent. Farmers had to buy expensive farm inputs, and then experienced low prices for their farm products, mounting unpaid loans, increasing pests and diseases, cultural debasement, insecurity and an uncertain future. There was also degradation of their immediate environment that supports their lives and livelihood.

When MASIPAG was established in 1986, rice improvement through breeding was on the forefront of its program aims, and grounded this approach as a strategy of both rural development and resistance.

When MASIPAG started its People’s Organization-led rice breeding program, MASIPAG opted for simple and convenient method of handling the variable progenies – the modified bulk method.

Initial preparations
MASIPAG rice breeding is performed as a participatory undertaking with individual farmers at the People’s Organization (PO) or Farmers’ Organization (FO). This alternative approach includes planning, implementation up to evaluation and eventual sharing.
The farmers must first establish the objectives of their breeding program and to accomplish the goals, farmers must procure the right parental material for the breeding work.

Prospective plant materials were continuously grown for two or three seasons as characterized and selected parents have to be locally adapted and maintained organically.

**Synchronization of flowering**
To effect pollination, the male and the designated female parents must flower at the same time. To ensure this, the number of days each partner parent is expected to flower, as reckoned from the date of sowing the seeds, must be determined. The parent lines are then sown so that they will flower on the same date. For example, a parent that flowers in 90 days has to be sown 10 days earlier than its partner that flowers in 80 days.

**The Breeding Proper**
To make a cross and create new, different plants, the designated female parent must be pollinated with pollen from the ‘male’ parent. Materials needed to do this include the flowering plants, small sharp pointed scissors, forceps, glassine bags, paper clips, and a black pentel pen. The anthers (six of them in a flower), the flower part that produces the pollen, must be removed from the flowers of the “female” parent before they pollinate themselves (“selfing”).

**a) Identification of the Mother and Father Plants**
The best plant of the paired parents serves as the mother since this contributes about 60% of the genetic material in the resulting offspring. The male parent contributes the other 40%. Hence, whichever line is considered better, in terms of productiveness, resistance, uniformity, earliness, and height or even if it has a better eating quality, will serve as the mother plant.

**b) Emasculation**
Emasculation is the process of removing the anthers a day before pollination time. This is usually done in the afternoon when the stigma and ovary, the female parts of the flower, are inactive and pollen shedding has ceased. A healthy panicle whose flower is already one-third exposed is chosen for emasculation. The entire flower is carefully exposed, removing the top and bottom thirds of
the panicle. Forceps are used to remove whatever anthers remain inside the opened flowers.

**c) Pollination or Pollen Transfer**

On normal sunny days mature anthers will emerge and shed their pollen at around 10am. Flowers from the designated male partner are cut and at least two are placed just above the emasculated parent and lightly tapped to induce pollen shedding. The name of the male parent and the date of pollination must be added to the label. Pollination may be repeated the next two days, as the female plant remains receptive up to three days after emasculation.

The first generation seed from the cross (F1) takes about 28 to 30 days from pollination to mature. The seeds remain dormant for about 15 to 20 days.

**d) Care and Management of the F1 Seeds and Seedlings**

The almost naked F1 seeds may appear to be abnormal as they look as if they are partially burned. Several seeds are sown in moistened paper-lined petri dishes to germinate. In about a week, germinated seedlings may attain a height of 3 – 5 cms. They are transferred to small pots and grown to 15 to 18 cms before being transplanted into the nursery. Ten to 15 healthy seedlings are selected and planted singly with seeds from the mother plant planted alongside to serve as control.

Indications of a successful breeding includes: seeds form (firm or hard), seeds germinate, germinated seeds grow to maturity and bear seeds, and finally the new plants are distinctly different from the mother plant in some observable features or traits.

**The Selection Process**

About 90% of the total effort invested in rice breeding is spent on the selection process. From the initial crossing, or “hybridization”, many plant types bearing various traits appear in the resulting population. This is the result of the transfer and recombination of genes. The best of these plants are selected for further development.

**a) Objectives of Selection**

It should be remembered that the selected plants, i.e. the “selections”, must possess the traits or combination of traits that accomplish or satisfy the objectives of the breeding program. For ex-

Perfecto Vicente studies examples of Masipag Rice
ample, if the goal is to create more productive cultivars, the selection must exhibit traits related to productivity, like having more tillers, higher percentage of productive tillers, etc.

b) Ways of Handling Segregating Populations

Selection in MASIPAG is conducted through the Modified Bulk Selection Method (Figure 1). For busy farmer breeders, this method is simpler and more convenient than the single cross method, making it more practical for their circumstances.

In the selection process, two important plant traits indicative of variability are maturity and plant height. In single cross method, the seeds of ten plants are harvested and mixed to serve as a single source of seeds for the next planting.

During harvest time, the best plants are harvested and the seed is bulked together to serve as the first bulk sample. After ten days, another sample is obtained and designated as the second bulk and after another ten days a third bulk sample is obtained if there are still productive plants. The samples will be the early, medium and late maturing group containing short, medium or tall plants.

In the next cropping season, the three bulk samples are planted in different plots. Sub-bulks may be obtained from each group to produce samples distinguished from one another by maturity and height combinations. In the ensuing generations, further sub-bulking may be done using variables like panicle length, grain density, color, etc. creating many possible selections to choose from.

This has been the process used to produce MASIPAG selections that are still being grown by network members of MASIPAG across the Philippines. Table 1 shows a comparison of the MASIPAG modified bulk selections and conventional rice breeding method.
The Strengths of the Bulk Method are:

- Simple, convenient to monitor and practical for farmers
- Selections are more diverse
- Selections have many sources of genes
- Breeding process is shorter
- Selections are stable, tolerant and durable

**Results**

Currently, MASIPAG has already developed more than one thousand selections, from its 400 rice crosses. Nomenclature of MASIPAG rice is M, signifying a MASIPAG line with numbers following representing the cross, bulk, and selection number. For example, M11-2-1 means that it is the eleventh cross done in MASIPAG, while two is the bulk number, and one is the segregation group number. The red rice are labeled with the letter R, for example M105-2-1R.

Rice breeding can result in different selections with different characteristics. Distributing the segregating lines to different farmer groups in different agroclimatic conditions maximizes the number of selections.

**Conclusion**

Through the modified bulk selection method, MASIPAG farmers have developed and improved many rice varieties. These improved selections have been planted in 47 provinces of the Philippines by at least 35,000 farmers.

Because the breeding and selection method is very simple, farmers from different localities or countries can easily replicate the experience. The only pre-requisite is interest and determination.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>MASIPAG Rice Breeding</th>
<th>Conventional Rice Breeding</th>
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<tbody>
<tr>
<td>Breeders</td>
<td>Farmers</td>
<td>Scientists, Researchers</td>
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<td>Breeding</td>
<td>Modified bulk</td>
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<td>Seeds</td>
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<td>Traditional rice varieties</td>
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<td>Technology</td>
<td>Local adaptation</td>
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<tr>
<td>Biodiversity</td>
<td>Enhanced</td>
<td>Eroded</td>
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</table>

Table 1: Modified bulk selection method versus Conventional breeding.
Borlaug, the Green Revolution, and Organic Wheat

By Hannah Jones and Mike Gooding
University of Reading UK
Email: h.e.jones@reading.ac.uk

In intensive agriculture, developments in crop management, agrochemicals, mechanization and breeding have contributed to increased wheat yields over the last hundred years. Between the 1950s and the end of the last century UK wheat yields increased by about 110 kg/hectare/year (Austin, 1999). Much of the change was associated with a reduction in crop height: shorter crops had a higher proportion of the crop biomass in the grain, and could also receive high levels of synthetic fertilizers to produce large canopies without lodging. Conversely, however, shorter crops were found to be less competitive and hence more reliant on herbicide use. In addition both increased the nitrogen use and a shorter stature increased susceptibility to a number of fungal diseases, and hence increased reliance on fungicides. The whole package of shorter wheats, improved seed supply, and increased use of fertilizers and agrochemicals under-pinned what has been coined the ‘Green Revolution’. The name most synonymous with the Green Revolution in wheat is Nobel Prize winner, Norman Borlaug who, in Mexico in the 1950s, produced plants that were shorter and more widely adapted because they were less sensitive to day-length (photoperiod insensitivity). The ‘Green Revolution’ package, however, is not without its critics on socio-economic grounds, and the increased use and reliance of synthetic fertilizers and agrochemicals brings into question its sustainability and whether it has anything to offer organic farmers. A few months after the death of Norman Borlaug is an appropriate time to appraise whether the shorter wheat type is useful for organic farmers.

It should be first acknowledged that farmers were keenly aware of the potential benefits of shorter wheats, long before the advent of synthetic fertilizers and agrochemicals. In 1852, Thomas Garnett in the (UK) wrote: “… [in short strawed wheats] the proportion of grain to straw is larger than in a long strawed wheat...”. This relationship in resource allocation, defined by the term harvest index, between the ear and the straw has been long recognized by farmers, but it was not until the introduction of dwarfing genes that significant yield improvements were achieved. That yield potential went hand-in-hand with the benefits of fertility had also been accepted a century before Borlaug because “…on rich soils…long strawed wheat is liable to be spoiled by being laid…” (Roberts, 1847).

Secondly, Borlaug was not the first to incorporate major dwarfing genes into a wheat breeding program. Strampelli was an Italian wheat breeder who, like Borlaug, but some thirty years earlier, introduced genes from short Japanese wheat varieties. Many modern day wheat varieties grown in Southern Europe still carry the ‘Strampelli’ genes.
Clearly, the perception of the benefits of shorter wheats predated the intensive use of synthetic fertilizers and agrochemicals. The demands for reduced height must, however, be balanced against the advantages of weed suppression with the taller varieties (Hoad, 2008); resistance to some diseases (van Beuningen & Kohli, 1990), and straw yields which are desirable for mixed farming systems. Under organic management, taller cultivars are often chosen by farmers, but the relative benefit does depend on the cropping environment, particularly weed pressure (Cosser, 1997; Addisu, 2009a).

The dwarfing genes in modern cultivars can be broadly classified into two groups. There are those that have a mechanism that reduces the sensitivity of the plant to gibberellic acid, a plant hormone that influences stem elongation; this is the method used by Borlaug. The second method includes reducing the duration of stem extension with photoperiod insensitivity. The improvement in cultivar performance, which may be partially attributed to increased harvest index over time, is unquestionable under intensive management. However, these advances are often significantly less when the same cultivars are grown under organic conditions (Przystalski, 2008; Addisu, 2009a). Similarly, improvement in capture and use of nitrogen for grain protein production in modern wheat varieties is only evident when cultivars are compared in intensive, conventional management systems (Figure 1).

Recently, Addisu (2009b) showed that dwarfing genes associated with gibberellic acid insensitiv-

![Figure 1: The relationship of protein yield (the product of grain yield and grain protein concentration) for 19 cultivars when grown organically (●) and conventionally (○) for different release dates (indicated as age from 2009). Derived from Jones, 2009](image-url)
ity have sometimes reduced early resource capture. This would partly explain the relatively poor performance of modern cultivars (those released in the last 30 years) in organic systems compared to their performance under more intensive management. In organic systems, nitrogen is often plentiful in the early season – from ploughed-in, legume-rich leys – but deficient later in the season, which reduces the risk of lodging. Based on this fertility-building regime, a desirable trait for cultivars in organic systems is early season growth (Baresel, 2008), which not only takes advantage of the early season nutrients, but also increases competition against weeds. This is demonstrated in Figure 2, where early season growth, defined by the February growth score, has a disproportionate benefit on yield when under organic compared to intensive (conventional) management. In contrast, dwarfing genes associated with hastened development and reduced duration of stem extension have increased early resource capture; this early development enables the crop to take advantage of the fertility from leys. The shorter lifecycle of these photoperiod-insensitive lines, however, can be a disadvantage under intensive management as the total resource capture for the crop is reduced, while in organic systems the reduced length of the lifecycle can be compensated by early season growth (Addisu, 2009a).

Photoperiod-insensitive cultivars have been marketed in the UK for late sowing and early harvest, allowing increased rotational flexibility (Addisu, 2009a). It could be argued that there are potential advances in organic systems with varieties that contain the photoperiod insensitivity genes,

Figure 2: The relationship between February growth* and yield of 63 wheat lines derived from Savannah x Renesansa when grown organically (●) or conventionally (○).

*The February growth score is a combination of the measurements of ground cover, light interception, plant population, dry matter and nitrogen accumulated, and crop height (derived from principal component 1 in Addisu, 2009).
as they have the early resource capture characteristics (Baresel et al. 2008) but also possess a suitable background to provide some cold tolerance in the early season.

To conclude, the benefits of shorter wheat varieties, in terms of reduced lodging and increased harvest index, are relevant to organic producers. These benefits were recognised by farmers long before the intensive use of synthetic inputs. It is possible, however, to reduce crop height with genes that do not reduce early season growth and competitiveness; such genes may be particularly useful in organic systems of production.


The organic farming sector has grown rapidly over the last decade. However, one of the key challenges to a continued success story is the limited availability of organic seed. This is seed that is produced sustainably, in accordance with organic principles (e.g. natural pest control and limited use of synthetic fertilizer) and without the application of modern biotechnology (IFOAM 2006; Lammerts van Bueren et al. 1999). Although organic standards increasingly require the use of organic seed, these are only available for a limited amount of plant varieties, only in limited quantity and are provided by a limited number of suppliers.

Seeds are the basis of any farming system and form the fundament of the world food supply. Without seeds, there are no crops, hence, no food. Global food security is thus closely tied to the availability of healthy seeds. Amidst the current trend of rapid environmental degradation and poor socio-economic conditions in many parts of the world it is of major importance that a reliable organic seed supply is ensured so that sustainable agriculture is able to contribute to food security.

Organic plant breeding is, however, suffering from insufficient seed availability, which is the result of, among other things, intellectual property rights. These rights are problematic for a number of reasons, most significantly being the limitations posed on seed saving (for future sowing) and seed exchange.

With an emerging opposition to the current dominant system of intellectual property rights, there is a growing interest in and exploration of alternatives. This article discusses two of these. First of all, the option of “common ownership” is presented, illustrated by a case study from Germany. It successfully facilitates organic plant breeding within the current legal system. However, it is not the perfect solution and, therefore, the second alternative presented here is “open source biology”, which has great potential to overcome intellectual property issues and increase seed availability.

**Intellectual property rights**

Intellectual property rights provide a monopoly (i.e. exclusive rights) over creations of the mind. Within intellectual property law there are various categories of rights, for example copyrights, trademarks and patents.

Nowadays, intellectual property law is regulated on the international level by the agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs), which was negotiated in 1994 and is administered by the World Trade Organization (WTO).
The TRIPs agreement requires WTO member states to “provide for the protection of plant varieties either by patents or by an effective *sui generis* system” (article 27). “Sui generis” refers to a legal system “of its own kind”, implying that it is different from a patent system. Although not mentioned in the TRIPs agreement, it is commonly assumed that the convention adopted by the International Union for the Protection of New Varieties of Plants (UPOV) is the appropriate, effective *sui generis* system (GRAIN 1999).

The UPOV convention requires member states (in total 68 in 2009) to grant and protect breeders’ rights (UPOV 1991). While the 1978 act allows farmers to save seed for their own use, under the 1991 UPOV Convention (article 15), this so-called farmers’ privilege is an *optional* exception to breeders’ rights. National governments are free to decide what this farmers’ privilege precisely entails. In addition, under the 1991 Convention, farmers are not allowed to use, exchange, or sell any licensed seed material, resulting in limited exchange between farmers and breeders (UPOV 1991).

Many of the plant varieties cultivated in organic farming are local, traditional varieties that cannot be registered, because these varieties do not meet the requirements of being new, distinct, uniform, and stable, which are the four criteria for registering a plant variety and be granted breeders’ rights (UPOV 1991; Kastler 2005).

**Work with the system: common ownership**

Involvement of a range of stakeholders is not uncommon in organic plant breeding, especially not in the global South (Lammerts van Bueren et al. 1999). With costs of the breeding process shared among multiple parties, it is desirable to also share the resulting benefits. One way to enable shared benefits is the implementation of common ownership (Scialabba et al. 2002). Within this concept, the breeders’ rights are shared among all participants (Scialabba et al. 2002).

Participatory approaches and the concept of common ownership are already applied in many plant-breeding program (Lammerts van Bueren et al. 1999; Scialabba et al. 2002). The success of this approach is illustrated by a case study from Germany.

In Germany, the Association for Biodynamic Vegetable Plant Breeding ("Kultursaat") is a network through which biodynamic farmers cooperate to develop biodynamic seed (Kultursaat 2007; Scialabba et al. 2002). Not only does the association promote plant-breeding work and raises funds, it also provides a comprehensive structure for (financial) benefit sharing (Scialabba et al. 2002).

Breeders (mostly farmers) receive funding for breeding programs from the association. When a new plant variety has been developed, the breeder applies for registration and breeder rights. Once breeders’ rights are granted, the breeder then transfers these rights to the association, so that benefits resulting from the rights are shared among the members of the association (Kultursaat 2007).

Besides the association, the network has set up an independent seed company named Bingenheimer Saatgut that produces and markets the seed bred by the association (Kultursaat 2007). Bingenheimer Saatgut pays license fees to the association. Because Bingenheimer Saatgut is owned by Kultursaats’ breeders and farmers (shareholders), the roy-
alty payments flow back to those who bred the plant variety (Kultursaat 2007).

Thus, both costs and benefits are shared through the association and the seed company. At the same time, this structure allows for the exchange of seed, experience and knowledge between breeders and farmers. This structure has proven to be successful: so far, the association has registered more than 35 vegetable varieties (Kultursaat 2007).

However, common ownership is not the perfect solution to the problems resulting from an increasingly dominant intellectual property regime. Even within a structure such as the one used by Kultursaat, plant breeders’ rights are still limited to those who are member of the association. It also comes with substantial administrative bureaucracy, and, most significantly, it overlooks the collective nature of plant breeding. To overcome these issues, the plant-breeding sector should consider open source biology, which is a concept inspired by the open source and free software movements.

**The open source and free software movements**

The clash between intellectual property rights and the plant-breeding sector is not an isolated phenomenon. Other industries experience similar problems. An exemplary example is the software industry, which is increasingly faced with strict limitations on exchange of knowledge, experience and collaboration. In order to overcome these limitations, the software industry initiated the open source and free software movements (Stallman 2009).

Crucial features of these movements are free access to the source code, as well as free distribution of the software. This means that there are no restrictions on distribution, including no royalties or fees once the product has been acquired (in most cases open source software is available free of charge). Also, there are no restrictions on modification of the software or even to use the software to derive new programs from it. Stallman, initiator of the free software movement, summarizes it as “Free as in free speech, not free beer” (Stallman 2009). There are a number of open source and free software licenses available, differing in the extent of freedom to modify or distribute the product.

**Open source biology**

The principles of the free and open source movements recognize the collective nature of developing quality products while still providing credit to the participants. It provides for inclusion rather than exclusion, facilitating exchange of material, experience and information (Kloppenburg 2008, Stallman 2009). The movements’ principles, therefore, provide great potential for the organic plant-breeding sector.

This alternative is referred to as “open source biology”. It has attracted the attention of a number of scholars and implementation methods are currently being explored (see e.g. Kloppenburg 2008). The power of open source biology for organic plant breeding lies in its positive approach to the current problems of intellectual property rights (Kloppenburg 2008). To merely protest against the current intellectual property regime is a waste of effort. Protestors will not be victorious unless a viable alternative is put in place, which is the same approach the software industry took when engineers felt more and more caged by intellectual property rights.
Successful implementation of open source principles requires persistence. When the free and open source movements put in practice the first license, various corporations tried to take advantage of it by copying the code and using it for new, derived proprietary software without even providing proper credits to the initial developers (Weber 2004). It was and still is not welcomed by powerful, monopolistic multinationals such as Microsoft, but it is gaining credibility, both through court cases whereby open source and free software developers have won against proprietary developers, as well as in output, which is proven by products such as Linux (Raymond 2004, Weber 2004). Empirical research indicates that open source and free software development comes with lower costs, shorter development time, and increased reliability, security and quality (Raymond 2004).

Conclusion
The success achieved by the open source and free software movement sets an example for the organic plant-breeding sector. Research on the implementation of open source biology is only at a very early stage, but success factors from the open source and free software movements should be evaluated for transferability to the organic plant-breeding sector.

At last, the shift from exclusion to inclusion fits well into the overall trend of moving towards alternative property concepts, which is also emerging in ‘green’ businesses such as car sharing networks and carpeting lease programs that exemplify moving away from strict private property towards shared or leased property. With biotechnology encroaching on the seed market, it is of utmost importance and urgency to now develop an alternative system. Open source biology offers a promising alternative.

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Indigenous Sheep Breeds in Croatia – Organic Farming as a Conservation Effort

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Introduction

“Everyone has a fundamental right to pleasure and consequently the responsibility to protect the heritage of food, tradition and culture that make this pleasure possible.”

-Slowfood movement mission statement

Sheep, donkeys and small-framed cattle are characteristic of the mountain regions, the coast and the islands of Croatia. These areas have a long tradition of sheep breeding and production of meat, milk, cheese and wool. The economic importance of these products has often changed over the course of history, but most dramatically in modern times. Nowadays, there are around 600,000 sheep in Croatia, 65% of which are of indigenous breeds, raised for mixed purposes. The remainder are either imported or mixed breeds. Out of nine indigenous Croatian sheep breeds, one is critically endangered (and two are endangered (The abundance and variety of the local breeds are a result of a breeding tradition, as well as the diversity of climate in which natural and genetic resources had to be used optimally.

Declining numbers of indigenous domestic animal breeds over the last century has been the result of increasing technological development. In addition, greater economic requirements and socio-economic changes have had a negative impact on breed numbers. Specifically, war, has caused a significant fall in the total livestock numbers. In the middle of the last century, leading Croatian (then, Yugoslavian) scientists lectured on the value of indigenous breeds, warning of incal-

The Bračka ovca sheep breed.
(Photo: Veterinary Faculty, Zagreb)
culable damage in case of their possible loss. Raising awareness over recent decades has meant the public is now well informed about the problem of preserving local breeds. Consequently, the Croatian Government signed and ratified the Convention of Biological Diversity, and created national strategies for protecting Croatia’s biological and landscape diversity. As an urgent measure, the Republic of Croatia increased the financial subsidies for the breeding of indigenous animals, and started several research and applied programs for their conservation.

The Veterinary Faculty at Zagreb has been a pioneer in organic sheep production, and is also a team member of several other programs involved in the protection of domestic breeds. After the successful completion of the project “Production of lamb meat certified as organic product of Croatia”, the Veterinary Faculty continued its conservation efforts through a scientific project titled “Standardisation of physiological blood parameters in indigenous sheep breeds”.

Description
Because of their distinctive resistance, ability to adapt and endurance, sheep are the dominant livestock species in the Mediterranean. Nearly 50% of the Croatian territory, and most situated in the Mediterranean region, can be classified as “karst”, a landscape with unusual features formed through the action of water on soluble bedrock. These areas can be called “virgin soils”, since they have never been polluted by industrial, intensive agricultural or livestock production. Eight out of nine Croatian indigenous sheep breeds are located in these areas.

Sheep in Croatia are mostly managed extensively, a low input production system that is a good foundation for the expansion of organic sheep breeding in Croatia. Their high adaptability to the local environment, disease resistance, modesty in food and care requirements gives these native breeds a great advantage in low-input production systems. In an environment where high input is impossible, which is the case in more than half of Croatian territory, low-input production is the only option. These facts present a perfect platform for the conservation of indigenous sheep breeds of Croatia.

(Continued on page 40.)
In-situ conservation is widely accepted as a method of AnGR (Animal genetic resources) conservation because it covers the widest spectrum of conservation objectives. In 2008 Croatia passed a Strategy and Action plan for the protection of biological and landscape diversity of the Republic of Croatia, however, a lot of research is still needed for optimizing conservation methods, whether or . Unfortunately, the ultimate goal of conservation – self-sustainability of the breed – is often neglected. It is clear that the production capacity of indigenous breeds is relatively low and that their populations cannot compete with other highly productive breeds and/or crossbreds. So, it seems that the protection of local breeds’ biodiversity (and biodiversity as a whole) depends on the commercialization of these breeds.

Possible Solutions and Recommendations
In Croatia, to achieve optimal results with the existent sheep breeds new ideas and the re-thinking of old principles is needed. One consideration is that small ruminant production conducted in an ecologically-acceptable manner is ideally suited to organic systems.

In addition, in order to keep small-scale food production systems viable, new ways of product branding and popularization should be implemented. These old/new gastronomic products are an example of a fusion of old knowledge and new trends. They serve as a natural link to public appreciation of traditional sheep production, their specific phenotype, tradition and ecologically sustainable uniqueness.

Throughout Europe, producers’ efforts are mostly aimed at obtaining the “designation of origin” status. This certifies products that are of superior quality, and are expected to carry specific characteristics of a geographical region or individual producer. The label makes it possible to achieve value-added prices in the market, justifying its protected status and governmental care.

The Dalmatinska pramenka sheep.
(Photograph: Veterinary Faculty, Zagreb)
Farmer cooperatives are another important factor in the support of organic production. Cooperatives contribute to rural economies, and offer the best opportunity for a farmer-focused and competitive agricultural business. One of the roles of agricultural organic cooperatives is to take into account the importance of developing long-term relationships with consumers, public authorities, agri-food structures and civil society.

There is an obvious need to establish tourist programs focused on Croatia’s protected natural heritage with an emphasis on the well-known authentic breeds. Responsible travel can simultaneously help protect communities, encourage expansion of organic agriculture and provide extraordinary visitor experience.

Possibly the most successful example of a permanent protection, which includes all of the points mentioned above, is the case of Istrian cattle. A project that reaffirms the importance of Istrian cattle, is already underway through the production program “Meat of Istrian cattle”. This project has initialized the consensus of all involved in the food-chain (production, processing, catering) and it is now reaping its first positive results. This project could act as a pilot project for similar projects with other indigenous breeds that are endangered for similar reasons.

Of course, the importance of education, campaigning, development of public appreciation and positive attitude towards such products and animals cannot be emphasized enough. It is an essential task that is the responsibility of all parts of the production chain – farmers, producers, teachers, agricultural advisors and scientists.
Possibilities for Breeding in Organic Dairy Farming

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In the organic sector there is an ongoing debate about the development of organic breeding methods. The debate revolves around two issues: 1) how the principle of naturalness in organic agriculture (that is, using natural processes wherever possible) can be reconciled with the increasing use of modern reproduction techniques in conventional breeding; and 2) whether animals produced by conventional breeding programs are actually suitable for organic agriculture or whether the organic sector itself should start producing animals that fit into organic production systems. Investigations into these issues gave rise to a doctorate research: “Selective breeding in organic dairy production” (Nauta, 2009).

Organic farming and breeding
Breeding has never been an important issue to many organic farmers. After they convert their farm to organic production, most farmers focus their attention on soil fertility and animal health, and continue using breeding stock from conventional supplies. However, when asked most farmers say they assumed breeding will become regulated within the organic certified process and part of the whole organic production chain (Nauta et al., 2005). The reasons given for this assumption are the modern reproduction techniques used in conventional breeding schemes and the imbalance between the breeding goals of conventional breeders and organic production. Organic farmers need dairy cows that can cope with organic production environments, where there is no or less reliance on the input of fertilizers, concentrates and medicines. In short, animals have to be able to produce under the conditions of the local farm resources.

The reproductive technologies used in conventional programs were of second concern to farmers. Consumers are not aware of such practices and, therefore, farmers feel there is little danger of public concern over organic farmers using bulls from such systems. However, farmers themselves did not feel good about it. When they made their decision to become organic, they would also have liked to change to an organic breeding process.

Breeding practices
Based on organic principles, breeding should be carried out along natural processes. The best organic way to breed animals is by natural mating. Realizing this, a growing group of farmers are changing the process by keeping a bull on the farm for breeding. This bull is often purchased from another farm or bred from one of the best cows in the herd that had been inseminated with the sperm of an conventional breeding bull. Some farmers in the Netherlands have started breeding bulls by using both parents that come from their own herd. In such a farm-based breeding program the farmer has to take care to avoid inbreed-
To do this they can use a kinship-breeding scheme (Nauta et al. 2005, see also ).

Many farmers and other stakeholders, however, agree that not all breeding can be done by natural matings. Bulls can exchange diseases between farms and animals, they are dangerous and many farms are not equipped for keeping bulls. Artificial insemination (AI) was introduced to tackle such problems and the dairy sector does not want to go back to ‘the old days’. Therefore, most farmers will continue using AI with semen from conventional bulls as the only method of breeding on the farm. Some farmers, who choose to work with their own bulls, may collect semen from their bull, a process that can be done by a specialized company. This semen will be diluted and frozen and can be stored in a nitrogen container at the farm and used for AI when needed. However, in the Netherlands such sperm cannot be used on other farms since it is not EU-certified.

Is an organic breeding program possible?

How can an organic breeding program be set up? For an individual farmer it is just a matter of introducing a bull onto the farm, and the decision to do this is based on personal preference. However, for a group of farmers or for the whole organic dairy sector the situation is more complex. Many farmers and other stakeholders (researchers, advisors, policy makers) have their own vision of what are the possibilities for organic breeding.

A breeding program using bulls for AI relies on the large scale data collection necessary for testing bulls and used to estimate breeding values. The dairy organic sector is relatively small for such a system and the reliability of estimated breeding values would be low, which makes a breeding program less effective. In addition, the populations of dairy cows on organic farming are very diverse. Many different breeds are kept and many farmers crossbreed their cows with many different breeds. As a result there are many small populations of dairy cows, for which a regular, traditional breeding program based on large scale testing is not possible in the conventional way. Such breeding schemes would also be very expensive for the small organic sector. Testing one bull costs about 30,000 euros. Therefore, a new way of organizing organic breeding is necessary.

Use what we have

The organic dairy sector has many farmer-breeders who like to breed a specific, native or exotic breed or type of cow for their own farm. Some manage this with AI bulls, others with bulls raised in the herd. If using AI there is the supply of semen from conventional breeding programs. The biggest supply of semen on offer is from Holstein bulls, but semen from bulls of many other breeds (native and from abroad) is also available on the market.

When using AI, national borders do not apply, and breeding with bulls from different countries is possible, thereby broadening the market and increasing the genetic base that is available. This
could make the possibility of an organic breeding program more feasible, although, to make the best use of the international aspect of breeding more information on genotype-environment interaction between different organic populations would be necessary. On top of this the organic sector needs a cheaper system for selecting and testing bulls. Waiting until a bull has a high reliable breeding value is impractical. So a so-called ‘cold’ system, in which the bulls are culled (or sold for natural mating) after a collection of a certain amount of semen, may be more appropriate.

The individual breeding farms are the basis of the system, these farms provide specific genetic lines bred by kinship breeding (pure lines) or combination breeding. These latter breeding farms use bulls from other (organic or conventional) farms and combine specific traits that are important for organic production. The kinship breeders use bulls from their own herd and provide bulls with ‘double blood’ for specific traits. In an overall breeding scheme, other farmers can purchase bulls or semen from these different farms using bulls from the same breed or a different breed for crossbreeding.

**Stimulating the process**

The possible breeding scheme describe above are not a reality and may never develop in this way. It is a vision based on the conclusions from a PhD research project. The question is can breeding programs be developed this way. To find out more about the possibilities of this system, three different aspects need to be considered: the overall breeding program; the supply of semen from organic AI bulls; and the nucleus breeding based on kinship breeding and line breeding. The first step would be to simulate an overall breeding program for different population sizes (national and/or international) and traits, and to look at the genetic progress and prevention of inbreeding. The next step would be to develop a bio-AI network by building up a supply of frozen semen from a number of AI bulls that were bred on organic farms and bringing this to the market. This has already begun and the first bull was launched in October 2009. Further, a network of nucleus breeding farms (line breeding and kinship breeding with different breeds) has been set up. With information collected from these projects it is hoped to build further on the development of organic dairy breeding.
Young bull system

Two important issues in the set up of an organic breeding program are its genetic progress and the cost of the system. With the relatively small organic populations it seems impossible to compete with the genetic progress that can be made in large conventional programs. Also, the cost of selecting bulls is too high for the small organic sector. The small sector and the high costs per bull also make it difficult to control inbreeding, a relatively large number of bulls must be available to ensure against this. To tackle these problems a so-called “young bull” system might be a possibility. This concept was developed for the Guernsey breed, by Bichard (2002). In this system every year a relatively large group of young bulls are selected and used by the farmers for AI. After a small amount of semen has been collected the bulls are then culled, making it a “cold system”. By introducing new bulls every year and by selecting bulls from mothers that fulfil the breeding goals best, the generation interval is shortened. This means the genetic progress can compete with the genetic progress of a large scale testing program. By using enough young bulls from different genetic lines per year, inbreeding can be controlled easily. This system can be used over larger populations but is, in fact, also used at a farm level in the kinship breeding scheme.

References


Reviving Beneficial Genetic Diversity by Participatory Evolutionary Plant Breeding for low Input Farming System in Iran

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Introduction

Evolutionary plant breeding (EPB) is a plant breeding method developed by Suneson more than 50 years ago (Suneson, 1956). However, despite its age it can be considered as a modern plant breeding method, capable of coping with current problems caused by climate changes and by the negative impact of conventional and centralized plant breeding. Conventional plant breeding has mostly benefited farmers in hospitable environments and those who can afford inputs such as fertilizers and pesticides and have access to water. Unfortunately, this has meant the majority of farmers in marginal areas of developing countries, who are too poor to afford farm inputs get left behind. As a consequence, low yields, crop failures, malnutrition, poverty and eventually famine, still affect a large proportion of humanity (Ceccarelli, et al. 2001; Haghparast, et al. 2009).

Participatory Plant Breeding

Participatory plant breeding (PPB) programs are systems where scientists work in partnership with farmers to develop varieties adapted to the farmers’ farming systems. Such programs can help farmers cope with their harsh growing conditions. Conversely, the output of conventional plant breeding cannot help poor farmers in this regard. One of the main objectives of conventional breeding programs for self-pollinating cereal crops is to develop genetically uniform varieties with a wide range of adaptability. This genetic uniformity is considered to be a negative factor when tackling inhospitable environments and climatic changes. Increasing genetic diversity within a crop acts as a buffer against climate change (Haigh et al. 2007). Breeding for sustainability is a process of fitting varieties to an environment instead of changing the growing environment by applying fertilizer, water, pesticides, etc., to fit the variety (Coffman and Smith, 1991; Murphy, 2008). The same principles should be used in breeding programs aimed at increasing adaptation to climate changes, with the difference that there is a higher degree of complexity because the environments are always shifting (Murphy, 2008).

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There are different strategies that wheat breeders can employ to use genetic diversity to develop resilient varieties, including multi-lines, mixtures and evolutionary, or population breeding (Murphy, 2008). In participatory-evolutionary plant breeding, farmers’ selection works with natural selection on a genetically diverse population, encouraging maximum adaptation to environments with specific stresses and also maximum resilience against climate change. The use of mixtures of varieties further increases genetic diversity, and allows greater internal buffering in response to variable growing conditions (Finckh and Wolfe, 2006). Thus, evolutionary plant breeding (EPB), in which segregated populations derived from crossing a range of parents, is an effective and practical approach to developing varieties with a large genetic diversity (Suneson 1956). The resultant mixture has a large genetic diversity, enabling the environmental variation to be buffered, both within and between seasons (Jain and Qualset, 1975). The diversity in farmers’ fields, especially in organic and low input systems, is wider than the diversity in research stations. Consequently, conventional plant breeding is not capable of producing varieties suitable for organic and low input systems, and the harsh conditions of marginal areas.

**Challenges ahead of EPB**

EPB is not a common approach. There are several problems associated in marketing a population that has variable characteristics. In addition, the current legal framework does not make allowances for the registration or selling of such material (Haigh, et al. 2007). The selection criteria for these populations are also different from those in conventional breeding programs. For example, qualities such as good weed suppression and nutrient scavenging are unimportant for varieties grown in conventional systems, but very important for low input, and organic agriculture in particular, systems (Haigh, et al. 2007). This means changes are necessary in current legislations of variety registration and in supporting the uniformity of cultivars and monoculture of a variety in a vast region and also in behavior of markets. These vital changes are the most challenging problem on the way of increasing genetic diversity, and allowing internal buffering in response to climate change through EPB.

**Evidences of positive impact of EPB**

Haigh et al. (2007) compared the performance of six composite cross populations (CCPs) with their parents and found that the CCPs were able to evolve to suit local conditions. After four years under natural selection in the field, the CCPs outperformed their parents for a number of traits, including canopy cover and grain yield. More importantly, the CCPs showed an improved ability to yield consistently well under a range of different conditions compared to most of the parent lines. Furthermore, at the organic sites the greatest total protein levels were achieved with the CCPs with male sterility, followed by the CCPs, physical mixtures of parents and last the parent varieties. After three years of exposure to natural selection in the field, there was a tendency for the CCPs to produce a higher grain yield than the parent cultivars, a tendency that was more evident at the organic sites (Haigh et al. 2007). They also reported that yield stability over the same period was higher for CCPs even in comparison with the physical mixture of the parents. They concluded that stability is the CCPs’ most important characteristic, which is why they yielded well in both high (non-organic) and low (organic) environments. They found that the CCPs grown on an organic site for three successive years, out-yielded
a non-resident CCP from a different organic site, concluding that the resident CCPs had evolved and were adapted to the local conditions (Haigh et al. 2007).

**Need for EPB in Iran**

In Iran there are about 2 million hectares of rain-fed wheat farms. The majority of these farms are in the cold and moderately cold regions of Iran where the most commonly grown variety is Sardari and a newly released variety called Azar-2, that was derived from Sardari as its maternal parent (Khazaei et al. 2009). Sardari, a widely adapted wheat landrace originating from Western Iran, was released more than 30 years ago. Formal seed multiplication encourages its availability and consequent predominance, and has caused the displacement of other old local varieties (Haghparast et al. 2009). Because there are few other options for farmers, Sardari is now cultivated in both favorable and less favorable rainfed conditions. Since its release 30 years ago, climatic conditions have changed and the area is now much drier than it was. Over these 30 years, through, the conventional rainfed wheat breeding program produced only one varieties considered better than Sardari. Azar-2, released 10 years ago, has more specific adaptation than Sardari, but it has not been adopted extensively by farmers (Haghparast et al. 2009).

Old Iranian farmers still remember those times when they had specific wheat varieties for their farms, each with different conditions and they missed them now. The farmers used to grow mixtures of different bread and durum wheat varieties on a specific farm and made high quality, tasty traditional bread from the flour obtained from the grain of that mixture. Now they complain about the taste and quality of their bread. According to official reports, about 35% of bread in Iran is wasted due to abuse of consumer (20%), poor baking technique (30%) and poor flour quality (50%) (Baradaran-Nasiri, 2008). To improve bread quality, the flour must be improved, and this can be achieved by mixing grains of different cultivars. So, by developing genetic diversity back into farmers’ field not only will the impact of climate change be mitigated, but the farmers can also have better quality bread with less wastage.

**Initiation of EPB in Iran**

In 2008-2009 an EPB program with barley in two provinces of Iran, i.e. Kermanshah and Semnan was set up. The material consisted of mixture of 1600 F2 populations, obtained from ICARDA. This mixture was divided into three sets, and handed to two farmers from Dalahoo and Rvansar regions in Kermansha province, and one farmer from Garmsar region in Semnan province. The mixture was planted on land under rainfed conditions in Kermanshah and under irrigated conditions in Semnan. The farmers were asked to grow and harvest this material, year after year, under the same conditions they would use for any future crops. In addition, farmers were told that every year, or at longer intervals, and as the population evolves and new, better adapted lines appear, they can make their own selections. These extracted individual lines or sub populations could be used by the farmers in their commercial farms. They also provided the breeder a new population from which individual plants could be selected for the next crossing program or for multiplication as pure individual genotypes. Meanwhile the original population continued to evolve. The individual lines could also be maintained in a gene bank as a precaution against losing the final evolved mixtures.
Most recently, in the cropping season 2009-2010, the barley EPB program introduced new farmers in the same region and six other regions. Farmers, participating in this program since its first year, were the witnesses of superior performance of this buffering mixture in their harsh rainfed condition, and now are more enthusiastic about the breeding program. Moreover, an EPB program for bread wheat has been started in Iran, using a mixture of wheat segregating population obtained from the breeding program of Dryland Agricultural Research Sub-Institute (DARSI), Kermanshah, Iran.

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A Collaborative Breeding Strategy for Organic Potatoes in the Netherlands

**Introduction**

Average potato yields in Dutch organic farming systems are rather low and variable (12 to 35 tonnes/ha) compared to Dutch conventional farming standards (50-60 tonnes/ha). The main reason for this year-to-year variation in yield is due to the disease known as late blight, caused by the pathogen *Phytophthora infestans*, the timing and severity of infection is unpredictable and very variable. In the last few years late blight has been so devastating in organic potato production that its acreage has decreased by 20%. The ability of the organic farmer’s agronomic toolbox to reduce the susceptibility of a potato crop to late blight is limited, certainly under the Dutch climatic conditions. Conventional breeding programs do not generate either a sufficient number nor appropriate types of resistant varieties for organic systems; and a separate breeding program for the limited area of organic potato production is simply not viable. Therefore, all concerned forces have joined together in an umbrella program called **Bioimpuls** for organic potato improvement. Within this program there is a joint breeding project aimed at developing better adapted and late blight resistant varieties. With financial support from the Dutch Government this organic breeding program started in 2008. It is managed through the cooperation of six potato breeding companies, organic farmers and breeding scientists from the Louis Bolk Institute and Wageningen University.

**Collaborative breeding strategy**

**Structure**

The organic breeding program has built on an successful collaborative structure between potato farmers and company breeders that has existed in the Netherlands for more than a hundred years, a set up that is hardly known in other European countries.

In this system each farmer-breeder discusses individually with the company breeder which combinations of traits they consider are desirable and which parent lines should be crossed to have the greatest chance of meeting the breeding goals. In this way the farmer’s experience in growing potato varieties and the breeder’s experience in heritability of traits are integrated. The company breeder is better equipped to conduct the crossings in the greenhouse and to collect the seeds. The following spring the seedlings are raised by the company breeders and offered to the farmer-breeder to grow on. On average, a farmer-breeder yearly plants 500-1,000 new seedlings, though some can cope with more. Each seed can be the basis of one potential variety. In the first year the seedling is planted and its progeny (4-6 tubers) are then evaluated and selected or discarded.
After the first year, the selected tubers are multiplied vegetatively, ensuring that there is no further segregation and therefore the selection is relatively easy for farmers. Farmer-breeders select for basic agronomic characteristics such as foliage and tuber appearance, length of stolons, tuber size and distribution, adding their own insights and preferences. The selection percentage is individual, but can for instance be 15% in the 1st year (150 out of 1000 clones), 33% (50 out of 150) in the 2nd year, and 0-30% in the 3rd year (0-15 out of 50). The company breeder will proceed with the clones that are selected by the farmer-breeder and will test them on further quantity and quality traits, and might end up with one potential variety that will be sent in for the official trials for variety registration.

**Contract for sharing royalties**

At the start of a collaboration between a breeding company and a farmer-breeder a contract is signed arranging the legal aspects of the collaboration, such as ownership of the genetic resources and sharing of the royalties. If a farmer-breeder’s selection is successful and ends up as a marketable variety, it will be registered in the name of the farmer-breeder, but the company will represent the variety in the market and will conduct its maintenance. Therefore, the company will collect the royalties and will keep a yearly account of the received royalties based on the volume of seed potatoes sold. The sharing of the royalties is usually on a 50-50% base, depending on the amount of work conducted by each party. The yearly selection effort of the farmer-breeders has contributed to an increase in the number of potato clones selected each year and therefore the chance of success. Thus, this system has, over the past years, achieved great progress in the Dutch potato breeding sector, with about 50% of the released Dutch varieties being a result of this collaborative system.

<table>
<thead>
<tr>
<th>Year</th>
<th>Activity</th>
<th>Company breeder</th>
<th>Farmer-breeder</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Choice of parents</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>1</td>
<td>Crossing and harvesting seeds</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Sowing and raising of 1st year seedlings</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>2-4</td>
<td>Visual selection in the clones for basic agronomic characteristics</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>5-8</td>
<td>Trials for production, resistances, quality and adaptation</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>5-12</td>
<td>Yearly visit and discussion on progress</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>9-12</td>
<td>Research for potential market, registration on national variety list, obtaining plant breeder’s rights</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>13-15</td>
<td>Market introduction, maintenance, collecting of royalties</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>13-15</td>
<td>Yearly accounts and sharing of royalties</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Table 1: Sharing of breeding activities in a collaborative model of potato breeding in the Netherlands.
Breeding for organic agriculture

Training courses

One of the aims of the Bioimpuls organic breeding program is to increase the number of farmer-breederers involved. The more farmer-breederers associated with a breeding strategy based on a ‘no cure/no pay’ basis, the more economically feasible the breeding program becomes. Before the start of the project only two of the 160 potato farmer-breederers active in the Netherlands were organic farmers. After 14 years of effort, one of these two farmers was recently successful with the selection of the variety called Bionica, which in 2007 was marketed by the associated breeding company C. Meijer B.V. In spring 2008 and 2009 the first organic breeding courses to introduce the basic principles of potato breeding and selection were organised for interested farmer-breederers. The course gives farmers more insight into the breeding process and helps them realize that such a long-term activity needs commitment, skill and time; and that, therefore, must be given organizational space within their farm management. Currently, a total of eight organic farmer-breederers have joined the organic breeding program where the farmers will be supervised by an experienced potato breeder.

Pre-breeding

Next to the breeding activities of farmer-breederers, there is also a need for a long-term pre-breeding activity to generate new genetic material, including new sources of late blight resistance by using material that was identified in earlier projects by Wageningen University. Therefore, specific crossings were made, including the introduction of new sources of resistance found in the species *Solanum bulbocastanum*, *S. berthaultii*, and *S. okadae*. It is planned that as much as possible these new sources of resistance should be integrated into a genetical background that includes other required traits for organic potato, such as nitrogen-efficiency, resistance to *Rhizoctonia* and early blight, and early tuber setting and bulking.

Collaboration between central organic (pre-) breeding program and commercial breeding

The organic potato breeding program now includes the cooperation of six commercial breeding companies that are already involved in the propagation of organic seed potatoes. The farmer-breederers are all attached to one of these companies. Each year the farmer-breederers receive seedlings from the central organic breeding program, conducted by Louis Bolk Institute and Wageningen University, and/or from their commercial breeding company. The breeding companies can produce crosses with their own selected parents as well as derive new genetical sources from the central organic breeding program. Through a contract between the central breeding program and the involved farmer-breederers and breeding companies, it is agreed that in future...
when varieties derived from plant material from the central breeding program are registered, 10% of the royalties will flow back to the program. This means that the program will be able to partly generate its own income for future breeding activities.

**Future**

An organic breeding program as described in this article can only be successful and economically feasible when the number of organic farmer-breeders increases. It is estimated that at least 20,000 seedlings per year need to be tested for the program to be viable. Potato breeding is a long-term activity and is a continuous search for new resistance sources. The recent release of a new late blight resistant variety shows that with the efforts of more organic farmer-breeders the selection of a range of varieties suitable for organic potato production in the future is achievable.

However, the resistance traits that will be used in the organic breeding program are based on racespecific *R*-genes. This kind of resistance is assumed to be not durable. Therefore, the project’s program will include pyramiding of two to three genes from different sources in many different combinations. However, in the field one can only see whether a clone is resistant or not, and not whether the resistance is caused by one, two or three genes. In the future, marker assisted breeding using freely accessible markers, will be a necessary instrument to achieve such adequate pyramiding.

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**Figure 1.** Overview of the collaboration between the central organic potato (pre-)breeding program Bioimpul, the farmer-breeders (FB), some independent small breeders (SB), and named commercial breeding companies in the Netherlands, 2009.
Introduction

The selection of wheat cultivars for low-input and/or organic environments is not a priority in wheat breeding programs in North America. Ceccarelli (1996) suggested that breeders justify making selections under optimum conditions because the greater environmental variability of low-input conditions reduces heritability. Nevertheless, the rankings for disease resistance and quality traits in conventional trials have been reported to be similar to those of organic cropping trials with both wheat (Mason et al. 2007a) and maize (Burger et al. 2008). Initial studies (e.g. Mason et al. 2007b) provide some evidence that there is an interaction between a cultivar’s genetical make-up and the environment, whether it is growing under organic or conventional conditions.

The applicability to organic agriculture of trials conducted under conventional conditions is questionable. Several studies have reported differences in the performance of wheat cultivars in organic and conventional management systems, with some cultivars being better suited to organic management in northern North America (Mason et al. 2007b). Murphy et al. (2007) selected for yield under organic management and found that cultivars ranked differently from those under conventional management. Przystalski et al. (2008) concluded that cultivars should be selected for traits important to organic farmers under conditions that closely match commercial organic farms.

The objective of the present study was to determine whether a breeding population of spring wheat exhibited different genetical traits under conventionally and organically managed agricultural systems, and whether the lines selected would be different between systems.

Description

A detailed description of the experiment, including an explanation of the statistics used, can be found in Reid et al. (2009b). In brief, an inbred population was created by crossing two spring wheat cultivars, AC Barrie and the CIMMYT cultivar Attila.

The experimental study was conducted from 2005 to 2007 at the University of Alberta Edmonton Research Station (ERS), Canada, with the conventionally managed site less than 1 km from the organically managed site. On the conventional site, granular fertilizer was banded with the seed during sowing and broad leaf weeds were chemically controlled. No fertilizer or herbicides had

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2. Alberta Agriculture, Food, and Rural Development, Field Crop Development Centre, Lacombe, AB, Canada, T4L 1W8
been used on the organically managed site since 1999.

Results
The parent cultivars, AC Barrie and Attila, both yielded less grain with greater protein content under organic than under conventional management. Under the conventional system, the two cultivars had a similar grain yield, but in the organic system AC Barrie had 28% greater yield than Attila. In addition, AC Barrie was 17 cm taller, and the harvested grain had 5% greater protein content than Attila. Conventional trials, on average, yielded double the yield, and with less recorded weed biomass, than the organic trials.

The performance of the spring wheat grown from the cross between the two varieties were compared between the organic and conventional systems. The populations displayed similar grain yields, number of kernels per spike (flowering head), harvest index, flag leaf area, weed biomass, early season vigour, days to maturity, and grain fill duration under both management systems. However, the wheat grown in the organic system had a lower number of spikes per m², plant height, test weight, thousand kernel weight, and protein content. Where the observed response to selection did differ (harvest index, and weed biomass), there was no observed difference in heritability between systems.

Lines from the experimental spring wheat populations were selected for four traits — grain yield, grain protein content, number of spikes per m² and grain fill duration — under both management systems. When the selected lines were compared only half or fewer had been selected from both systems. For example, if the eight highest yielding lines (10% of the population) were selected from each management system only three of the lines would have been in common. Selecting the top twelve (15% of the population) and the top 16 (20% of the population) lines based on yield resulted in seven and ten lines in common, respectively. This suggests that selections for yield in further trials of a breeding program would result in large differences between the lines retained. The difference in the relative ranking of lines between systems was also large for other agronomically important traits.

Discussion
The experimental wheat population used in the study was at the developmental stage. The next step in its development would be a preliminary yield trial to select lines for replicated multi-location trials. To the best of our knowledge no such “breeding population” has ever been compared between conventional and organic management in North America.
We found that this breeding population showed heritable agronomic traits that were either similar between the two systems or lower in the organic system. This suggests that, at best, breeding under organic conditions would produce similar genetic gains to conventional breeding. However, breeding directly within organically managed systems would result in lower genetic gains than on conventionally managed land for some traits. Burger et al. (2008) reported on trials in maize where heritability for yield was similar between organic and conventional systems. It has been predicted that plants grown in competitive or stressful environments show less heritability (Fasoula and Fasoula 1997), but there have been exceptions to this, for instance in a trial that artificially induced weed competition in spring wheat (Reid et al. 2009a).

The results of the trial indicated that selecting the better yielding lines from the two management systems would result in large differences in the lines retained for further yield trials in breeding programs. The difference in the relative ranking of lines between the two systems was also large for other agronomically important traits. However, the selection did not differ between systems for traits with differing heritable characteristics. This suggests that genetic gain may not differ between the two systems, but that it would be more difficult to predict under organic conditions.

Breeding programs, whether in conventional or organic systems, do not make selections based on only one trait (Wolfe et al. 2008). Organic breeding will require selections based on traits specifically required for organic agriculture, and selecting in an environment requiring the expression of those traits (Loschenberger et al. 2008; Murphy et al. 2007; Przystalski et al. 2008).

References


Acknowledgements
The authors wish to thank all the support staff at the Edmonton research station and Drs James Holland and Rong-Cai Yang for their assistance in the statistical analysis and genetic correlation calculations. Todd Reid was supported by a Canadian Wheat Board Post-Graduate Fellowship. Our research group was supported by an NSERC Discovery and Collaborative grants, Western Grain Research Foundation (Check-off and Endowment Fund), and we gratefully acknowledge support from the Alberta Crop Industry Development Fund (2001 and 2005), and the Alberta Agricultural Research Institute.
The first Romanian Organic Forum

The first Romanian Organic Forum was successfully held from October 22-23, 2009 in Bucharest. Around 150 participants attended this two day-conference at the Romexpo grounds. They showed tremendous interest in the lectures given by international and national experts. The program was divided into several topics, including: production of organic food products; production and trade by organic farmers; the organic food market in Romania; trade of organic food; and control systems in production and trade of organic food.

The two national organizers were Bio Romania, the newly founded umbrella association of organic operators, and the Ministry of SMEs, Trade and Business Environment of Romania.

The two international organizers were the Dresden-based NGO EkoConnect, and the Geneva-based International Trade Centre (ITC).

EkoConnect, focusing on the development of the organic sectors in CEE-countries, has developed the concept of the event and supported the event logistically. EkoConnect is also the initiator and performer of the successful Organic-Marketing-Forum in Warsaw.

ITC, the joint agency of the World Trade Organization and the United Nations dedicated to helping enterprises from developing countries and transition economies become more competitive in the global market, ensured the overall management of the event. Financial support and technical publications on organic-related issues developed for its project “Export Development in Eastern Europe” were also provided by ITC. The Romanian Organic Forum 2009 came as the culmination of three-year ITC support to the organic sector in Romania, in the ambition to become a sustainable initiative.

As sponsors, the Dutch Avalon Foundation as well as a number of local supporters contributed to the Forum’s success. The world-renowned anti-GMO activist from Canada and winner of the...
2007 Right Livelihood Award, Percy Schmeiser, unexpectedly arrived with his wife Louise at the Forum shortly before the opening ceremony and was given space for a touching and alarming speech (see youtube) to the Romanian audience about the big threat of GMOs in the world and in the country.

As this topic is not at all public in Romania it was extremely important to give Mr. Schmeiser the opportunity to address the organic stakeholder community present at the forum. The scale of Monsanto’s influence in Romania was demonstrated when the University of Bucharest suddenly cancelled an event with Mr. Schmeiser the day before the forum, following a protest note by Monsanto.

The 1st Romanian Organic Forum pointed out how huge the interest in organic agriculture and organic processing and marketing are in the country and in the region. Mr. Bernhard Jansen, director of Ekoconnect, and Mr. Ralph Liebing (see Interview at youtube), market-developer of FiBL (Research Institute of Organic Agriculture) and director of ORA (Organic Retailers Association), agree that the idea to plant a sister-event of the Warsaw Forum in the South-East of Europe has fully taken shape as it was intended to.

Bio Romania as well as the Ministry for SMEs and the Ministry of Agriculture were very satisfied with the success of the Forum and are motivated to help the Forum earn a reputation equal to that of its sister event in Warsaw.

The Romanian Organic Forum is on the track to become a sustainable annual event with the potential to influence the overall development of organic in Romania, just as the organic fair in Warsaw has been doing since 2006.

For the Forum in October 2010, planning has already begun. A major focus of the 2010 event will be know-how transfer between successful stakeholders from Western Europe and South-Eastern Europe.
### Calendar of Events 2010

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<thead>
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<th>Event</th>
<th>Date</th>
<th>Location</th>
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<tbody>
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<td>BioFach</td>
<td>February 17-20, 2010</td>
<td>Nuremberg, Germany</td>
<td><a href="http://www.biofach.de/en">www.biofach.de/en</a></td>
</tr>
<tr>
<td>The International Institute for Environment and Development (IIED)</td>
<td>4th International Conference on Community Based Adaptation (CBA) to Climate Change</td>
<td>Dar Es Salaam, Tanzania</td>
<td>February 21-27, 2010 <a href="http://www.iied.org/climate-change">www.iied.org/climate-change</a></td>
</tr>
<tr>
<td>The Global Conference on Agricultural Research for Development (GCARD)</td>
<td>Montpellier, France</td>
<td>March 28-31, 2010</td>
<td>Sponsored by the Global Forum on Agricultural Research (GFAR) and the Consultative Group on International Agricultural Research (CGIAR) <a href="http://www.egfar.org/egfar/website/gcard">www.egfar.org/egfar/website/gcard</a></td>
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<td>Ecology Izmýr 2010</td>
<td>May 6-9, 2010</td>
<td>Istanbul, Turkey</td>
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<td>BioFach China 2010</td>
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