



RESEARCH NOTES

Short communication of practical oriented research or relevant information in agriculture or seed technology are presented in this section.

Production of Organic Seeds: Status, Challenges and Prospects

by

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Organic Crop Production Requires Use of Certified Organic Seeds

To maintain long-term food production there is a need for sustainable agricultural practices. This is one of the aims of organic farming and consumers are prepared to pay higher prices for certified organic products. In many developing countries agriculture is still largely based on low inputs, because farmers cannot afford the high costs of chemical fertilizers and pesticides. For such farmers, organic farming can provide a better economic alternative, especially if they are able to sell their products on the European and North American markets. For certification of organic products, it is important that the entire production process conforms to the rules for organic production. Although there are some minor differences between the regulations for the European and the North American market, both require that whenever available, organic seeds or plant material should be used.

However, this is not as simple as it looks. First, organically produced propagation material is not available for all crops or there are no appropriate varieties. Second, to produce seeds under organic conditions and to obtain seeds of the same quality similar to conventionally produced seeds may often prove more difficult. Third, for several crops

organically produced seeds are more expensive and in practice farmers may choose the cheaper conventional seeds. Fourth, seeds may be obtained through farm-saved seeds or through exchange within the community which are not always from a certified organic production. The latter can especially be the case in developing countries, where seed quality can be a serious problem compared to that of organic seeds supplied by major seed companies.

Availability of High Quality Organic Seeds

Organic crop production may demand even higher quality propagation material compared to conventional farming. Farmers should rely on the quality of the seeds they are using. Preventive measures using chemicals are prohibited and competition with weeds requires high vigor planting material. Moreover, for organic farmers, seed health and the absence of genetically modified (GM) contamination is also very important.

Several seed companies have invested heavily in the production of high quality organic seeds and planting material for the main production areas in Europe, North America, New Zealand, etc. There, organic seeds are available for a number of food crops. However, for some vegetable or agricultural crops it is very difficult to produce organic seeds of the same quality standards as for conventional farming, while for ornamental crops there is hardly any organically produced propagation material available. For biennial vegetable crops, such as cabbages, carrot and onion, it is even more difficult to produce high quality organic seeds because the two seasons required for seed production increase the risk of diseases and pathogen contamination. In cereals, organically produced wheat seed is available, but seedling emergence is often less than conventionally produced fungicide treated seeds mainly due to seed-borne fungal infections.

In the EU the use of organic produced propagation material is obligatory and permission for derogation should be requested for the use of non-organically produced material. However, there are still large variations in seed availability and the regulation was adjusted where three categories are defined. The first category includes crops where no derogation is allowed because enough organically produced propagation material is available. EU member states produce a national list of these crops. For example, crops such as cucumber, garlic, potato, wheat and barley are listed for the Netherlands. A second category includes crops where hardly any organically produced propagation material is available and there is at present no obligation to request for derogation. The list includes ornamental crops and trees, but also

strawberry, sweet corn, asparagus and hemp. For the third category, derogation can still be requested and granting depends on the availability of organically produced propagation material of the crop, which may vary between countries. The permission for derogation is the responsibility of the national authorities.

In other parts of the world the availability of certified organically produced seeds and plant material is even less, and serious difficulties are encountered to obtain organic seeds of a guaranteed high quality. For organic farmers in these areas the challenges may even be greater.

Challenges Encountered

In addition to the difficulties in production and availability of organic propagation material, organic farmers encounter other problems compared to conventional crop production. Since chemicals cannot be used during seed production, organic seed has a greater risk of contamination, both with weed seeds and with seed borne pathogens. Moreover, sowing of seeds in soils with organic manure, that has slower mineralization rate in cold spring, and a stronger competition from weeds may require high seed vigor and seedlings with a faster developing root system. Also, the guaranteed non-GM nature of organically produced products is an important marketing strategy to the consumers. With the global increase of GM crops, there is a risk of increased GM contamination. Discussions are underway at international level whether organic seeds need lower thresholds for contamination with GM seeds than non-organic seeds.

Seed Research

These challenges call for solutions, which can only be obtained through research. Appropriate methods for the detection of pathogens and determination of critical control points during seed production will provide the basis for disease monitoring activities and treatments. New seed sanitation treatments need to be developed that should not only be effective in the elimination of pathogens, but should also maintain the viability of the seeds. Such new treatments should meet both the standards for organic farming and international regulations for use of crop protection agents. Novel seed sorting techniques may also be of use by removing diseased seeds from contaminated lots or less vigorous seeds. Plant Research International is involved in a national research program on organic seeds funded by the Dutch government and in two EC funded projects; and collaborates with the seed industry, organic farmers and policy makers, to guarantee that results from research are acceptable to the organic sector and implemented in practice.

Some examples of this research are presented below.

Healthy organic seed production

Prohibiting chemicals in organic crop production increases the risk of diseases of some crops where resistant varieties are not available especially for biennial crops, which are exposed to infection during two subsequent seasons. To find alternative measures for optimizing organic seed production, we focused on gathering knowledge on critical control points during seed production. The host-pathogen combination *Daucus carota* - *Alternaria radicina* was chosen as a model. Several field experiments were carried out under organic conditions, using basic seeds of six different cultivars with various levels of *A. radicina* contamination. Disease transmission was studied and measured in all crop production stages, from seed to seed. Minor seed infections, which could only be detected with a sensitive method, seem to be responsible for non-visible latent infections in the crown part of the carrot root. These infections may become visible as black rot either at a high temperature above 20°C during maturation of the carrots or during cold storage of the harvested carrots. When young carrot plants or mature roots are vernalized to induce flowering, latent infections mostly remain unnoticed. Such infections can finally result in infected flowers and diseased seeds, and may form a source of inoculum for secondary infection of seeds developing on healthy plants. Consequently, organic carrot seed production requires a high degree of sanitation such as disease free basic seed, roguing at any stage of plant growth and a stringent isolation of production fields from other umbellifers. Besides, experiments have shown that hot water treatment of basic seed could be a good disease management practice.

Natural compounds for seed treatment

In Europe, most commercially produced seed is presently treated with (synthetic) crop protection agents, in order to eliminate seed-borne pathogens and to protect emerging seedlings from soil- and air-borne pathogens and insects. For organic agriculture, physical treatments such as hot water treatments are being used, but they involve the risk of seed damage. We are trying to avoid this problem by developing a combination treatment using milder physical treatments with compounds of natural origin.

Within this concept, different natural compounds were tested, including essential oils and organic acids. From 30 essential oils tested, thyme oil exhibited the highest *in vitro* inhibiting activity against two bacterial and two fungal seed-borne pathogens. It is important that these natural agents

are permitted for use on seeds according to the national and international regulations for crop protectants. Products that are not yet registered for use as a crop protectant will need the submission of new reports, often requiring costly toxicological studies that are not feasible for the small market of organic seed treatment. Besides, they should also be allowed for use in organic crop production (EEC regulation 2092/91 and FAO Codex Alimentarius). In the Netherlands, thyme oil fits both criteria and may be used for treatment of seeds when mixed with water.

Seed priming

When using organic manure, the microbial activity is very important for the release of nutrients. In the cold spring soil, microbial activity is low and nutrients become less readily available in comparison with the use of synthetic fertilizers in conventional farming. A vigorous seedling with a fast growing root system may improve the uptake of minerals and improve the establishment of the crop. In this respect vigorous, healthy seedlings may be even more important for the organic than for the conventional farmers. Moreover, faster growing seedlings can improve competition with weeds for nutrients and light. The latter is relevant, because manual and mechanical weed removals are major costs in organic farming. Seeds can be primed by imbibing them for a limited time prior to sowing. Mostly the primed seeds are dried so radicle protrusion during the priming process is avoided, to circumvent loss of desiccation tolerance. Primed seeds germinated faster in the field and this may contribute to an improved competition with weeds. Our research shows that plants derived from primed seeds show a faster initial growth and an earlier ground cover. It is interesting to note that farmers in India, Zimbabwe and several other countries obtained large increases in yield in low input farming systems, by using on-farm seed priming in wheat, rice and chickpea. Use of primed seeds can therefore be interesting for organic farming, especially in those areas where it is combined with low-input farming.

New seed sorting technologies

Alternative sanitation treatments (e.g. hot water treatment) require a high degree of tolerance of the seeds. During maturation, seeds reach their optimal physiological quality. Seeds which are not completely mature, germinate more slowly, have a lower germination capacity, produce less normal seedlings, can have higher contamination levels with pathogens, and can be more sensitive to diseases and to alternative sanitation treatments. Seeds of many crops are green during the first phase of their development, and the breakdown of chlorophyll is inversely correlated with seed

maturity. A technique has been developed to sort seeds on the basis of their level of chlorophyll fluorescence (CF). The most mature cabbage seeds, with the lowest level of CF, had highest percentage germination, more uniform and higher speed of germination and lower amount of infected seedlings. Less mature seeds showed a lower germination capacity and were more heavily infected than seeds from the low CF fraction. They are also more sensitive to hot water treatments, indicating the need for harvesting at full maturity for seed production. For barley seeds, a relationship was established between the strength of the CF signal and the level of contamination with *Fusarium* spp. Seeds from the fraction with the highest CF signals were always the most heavily infected. CF sorting of barley seeds improved their physiological quality by removing less mature seeds and those with the largest fungal infection levels. Therefore, the technology can contribute to improve the quality of organic seeds.



Future Prospects

The need for sustainable agriculture is acknowledged worldwide and many governments support research on organic farming. This provides prospects for improving organic seed production. The spin-off will also provide options to reduce pesticide use in conventional seed and crop production whereby organic seed research acts as a pioneer. Seed companies invest in organic seed production, despite the fact that the organic seed market is hardly interesting for major seed companies from the commercial perspectives. Collaboration between private and public institutions is increasing, both at the national and international levels.

The International Federation of Organic Agricultural Movements, the Food and Agriculture Organization and the International Seed Federation organized the 'First World Conference on Organic Seed' from 5-7 July 2004 in Rome, Italy. The meeting attracted over 270 participants from 57

countries, showing the worldwide interest in organic agriculture and the importance of seeds in organic food production. The diversity of participants was also reflected in the mix of farmers, seed company staff, small-scale seed producers, scientists and policy makers. ISTA also took part in this conference as a key player in seed research and analysis of seed quality.

The field of organic production and the use of organic seeds are rapidly evolving. Training of farmers, extension staff, researchers and policy makers needs attention. Several organizations such as IFOAM and ISTA can contribute to this need. Apart from pioneering research on organic seeds, the Wageningen University and Research Center also provides courses, both on seed technology and organic farming (<http://www.seedcentre.nl>).

It is very stimulating to see that the solutions proposed for organic seeds receive greater attention from the conventional seed sector. Conventional farmers are also interested in reducing the amount of chemicals used. In this way the challenges for the organic seed sector will provide prospects for more sustainable conventional agriculture.

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MEETINGS and COURSES

Announcements of meetings, seminars, workshops and training courses appear in this section. Please send us national, regional or international announcements for workshops, seminars and training courses organized in your country for inclusion in the next issue.

Conferences

AFSTA Annual Congress 2005, 16-18 March 2005, Yaoundé, Cameroon. The Cameroonian Seed Trade Association (ACOSEC) under the aegis of the African Seed Trade Association (AFSTA) will organize the AFSTA Annual Congress 2005. The congress will bring together seed people from Africa and the rest of the world and provide an excellent opportunity to create or strengthen business linkages. The AFSTA Annual Congress 2005 will be organized under the theme: *'Problems of Profitability of Seed Activity in Africa.'* However, other sub-topics and specific seed problems for the continent will be discussed. The

venue for the congress is Djega Palace hotels in Yaoundé. The registration form and the program along with all the details are available at <http://www.afsta.org>. For more information, contact: AFSTA Secretariat, P. O. Box 2428 KNH, Nairobi, Kenya; Fax: ++ 254-2-727-861; E-mail: afsta@kenyaweb.com; Website: <http://www.afsta.org>

ISTA Ordinary Meeting 2005, 25-28 April 2005 Bangkok, Thailand. This meeting will discuss and decide the proposals for changes to the ISTA International Rules for Seed Testing and the business of the Association, with the international participation of ISTA delegates and representatives from both the seed industry and governments, including experts in seed technology, scientific research and laboratory accreditation. The meeting will also discuss the ISTA Technical Committees and Task Forces (2004-2007); Rules Chapter for GMO testing; results of the ISTA GMO proficiency tests; accreditation of seed testing laboratories to issue ISTA Certificates for GMO testing; the new layout of ISTA rules; and the seed lot size for cereals. For more information contact: ISTA, Zürichstrasse 50, P.O. Box 308, 8303 Bassersdorf, Switzerland. Fax: ++41-1-8386001; E-mail: executive.office@ista.ch; Website: <http://www.seedtest.org>

West and Central Asian Regional Workshop on Plant Variety Protection Under the UPOV Convention, 8-10 May 2005, Karaj, Iran. The workshop will be organized by the International Union for the Protection of New Varieties of Plants in cooperation with the Ministry of Jihad-e-Agriculture of Iran, the Food and Agriculture Organization and the International Center for Agricultural Research in the Dry Areas with the financial assistance by the Ministry of Agriculture, Forestry and Fisheries of Japan. The participants are government officials responsible for plant variety protection system invited from Azerbaijan, Jordan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan and Uzbekistan where funding is already available from Japan. However, the workshop is open to other interested countries from the region that wish to participate provided that they can cover their travel costs and daily allowances. The Seed and Plant Certification and Research Institute will cover all local costs including accommodation and meals. If you are interested to participate please contact: A.J.G. van Gastel, Seed Unit, ICARDA; E-mail: a.vangastel@cgiar.org

8th International Workshop on Seeds: Germinating New Ideas, 8-13 May 2005, Brisbane Australia. The International Society for Seed