

PhD in SST

**ORGANIC SEED & CONVENTIONAL SEED:
SCOPE, PROBLEMS, PERSPECTIVES,
COMPARISONS AND SOURCES,**

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Organic seed : Definition

- Organic seed (planting material) is seed (planting material) produced by a crop that is planted and raised organically for at least one generation in the case of annual crops, and two generations in the case of biennial and perennial crops (Lammerts van Bueren, 2002).
- It is naturally that organic seeds are obtained by purchasing conventional non-treated seeds (C1), which are grown organically for one season and then sold on to organic farmers as organic seeds (C2).

Organic seed: Scope

- According to EU Regulation 2092/91, for organic farming, the organic sector had to close the organic chain using organic propagation material in Europe firstly by December 31, 2000, but it was concluded that there was a general shortage of organic seed for most crops.
- A. Cook wrote in 1999 about UK: “...in UK ... there is a general shortage of organic seed for most crops, but the main shortage must be defined as those crops that have no organically produced varieties commercially available.
- These crops include: oats, rye, triticale, parsnips, swedes, turnips and grasses and clovers.... Survey has shown that there is a severe lack of organic seed that is commercially available to UK farmers and growers.
- The extra three years given by the EU as an extension to the derogation for the use of conventional seed, should be used to stimulate and encourage organic seed production”.

Organic seed production: Problems & perspectives

- Organic seed supply will be insufficient by January 2006 in the country of Baltik region of Northern Europe
- Organic farmers have insufficient education in terms of seed quality importance.
- Short in funds and cannot buy double certified organic seed.
- (Belika and Bleidere, 2006)

Contd...

Lammerts van Bueren (2002) nominated the main problems in organic seed production.

1. Market problems are related to the limited area of organic agriculture and thus of the area of seed production per variety resulting in higher cost compared to conventional seed production. This will imply that the organic assortment of varieties per crop will be limited.
2. Technical problems have to do with the lack of experience of the formal sector with organic seed production without chemical inputs.
3. Problems with quality standards. The main problems are: disease and pest management, and weed control. Among the diseases the seed-born diseases require special attention.

This also brings up question and research needs related to seed quality.

Contd...

- In Europe & UK, a lot of research was done on adapting and improving cultural practice for organic seed production.
- This implies developing adapted varieties for healthy seed production, developing protocols for seed health test, assessing threshold values, designing organic seed treatment, etc.

Few illustrations on research, done for optimising organic seed propagation in late 1990-ties and in the first years of the new millennium

- **Denmark:** Problems of organic legumes and grasses seed production in Denmark; mode of sowing, provision with nitrogen without artificial fertilisers, restriction of insects' damage, etc. (Boelt *et al.*, 2001; Deleuran and Boelt, 2001; Boelt and Gislum, 2002; Boelt, 2003).
- In Denmark organic forage seed production has been established since 1992 and in 2000 organic grass and clover seed were produced on nearly 1000 ha.

Contd.,

- Production of one of the main constituents of forage mixtures, perennial ryegrass already in 2001 met the requirements for organic seed in Denmark and this grass species and its seed was available for export.
- Among the clovers, there is now a production of organic seed of red clover that matches the demand however another main constituent of forage mixtures white clover is still in request (Boelt *et al*, 2001).
- In 2003 in Denmark production of white clover (*Trifolium repens* L.) was still in request, too.
- Yields in organic white clover seed production are reduced by approximately 80% compared to conventional production.
- Research activities did not solve up to now problem of clover seed weevils.

Contd.....

- A survey in organic clover seed fields have shown that weevils are found in all organic white clover fields, that the yield reduction from these range from the weevil larvae may be 12 – 77 %. Currently research activities are continued (Boelt, 2003).
- **New Zealand's** experience suggests that organic vegetable seed production in covered area.
- Worldwide a lot of seed production (both conventional and organic) is now done in green houses because the environment and pollination can be controlled.
- It helps to keep seed free fungal diseases, too (Walker, 2003).

Contd...

- Prohibiting chemicals in organic crop production increases the risk of diseases for many crops, especially for biennials, which are exposed to infection during two subsequent seasons.
- Combination treatments were tried to develop using milder physical treatments with compounds of natural origin (essential oils, organic acids etc.).
- Groot *et al.* (2005) when testing 30 essential oils found that thyme oil exhibited the highest *in vitro* inhibiting activity against two bacterial and two fungal seed-borne pathogens of carrot.

Contd...

- Borgen (2001) wrote that the most effective preventive method for control of seed borne diseases is to only introduce healthy seed into the system.
- It is of vital importance that the seeds purchased are free from diseases – this is not automatically the case even though it has been grown on the basis of disinfected plant material.
- Seed borne diseases occur equally often in conventional non-treated seed as in certified organic seed.
- The choice of resistant varieties is also an important component in the preventive strategy.

Contd.....

- Despite of these activities and existing EU regulations problems in organic seed use still exist even in European countries. They are specified by Groot et al. in 2005 and they still are very similar to those mentioned by E. Lammerts van Bueren in 2002:
 1. Organically produced propagation material is not available for all the crops or there are not appropriate varieties.
 2. To produce seeds under organic conditions and to obtain seeds of the same quality similar to conventionally produced seeds may often prove more difficult.
 3. For several crops organically produced seeds are more expensive and in practice farmers may choose the cheaper conventional seeds.
 4. Seeds may be obtained through farm-saved seeds or through exchange within the community, which are not always a certified organic production. Seed quality can be a serious problem (Groot *et al*, 2005)

Seed quality

- Seed quality is issue of very high importance.
- 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.
- Preventing measures using chemicals are prohibited and competition with weeds requies high vigour planting material.
- Moreover, for organic farmers, seed health and the absence of genetically modified contamination is also very important.

Seed priming

- Primed seeds germinate faster in the field and this may contribute to an improved competition with weeds.
- Research shows that plants derived from primed seeds show a faster initial growth and an earlier ground cover (Groot *et al.*, 2005).
- New seed sorting technologies – a technique has been developed to sort seeds on the basis of their level of chlorophyll fluorescence (CF).
- For instance, the most mature cabbage seeds, with lowest level of CF, had highest percentage germination, more uniform and higher speed of germination and lower amount of infected seedlings.
- 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 of signals were always most heavily infected (Groot *et al.*, 2005).

Main reasons for derogation

- No organic seed available of the variety asked
- Variety is not appropriate for soil type
- Variety doesn't have the desired resistance, this is especially a problem with lettuce
- The market asks for another variety

Main issues of organic farmers

- The implementation of EC regulations differs between countries, leading to unfair competition
- For organic growers, the obligation to use organically produced seed limits their choice of crops; because the market for organic seeds is small, seed companies produce organic seed for only few cultivars and crop varieties
- Every year, new cultivars are brought onto the market (for example, Bremia resistant lettuce varieties), but organic seed for these varieties is not immediately available.
- It is difficult for organic growers to meet market demands for special vegetable varieties (with different tastes, shapes, colours) if organic seed or propagating material for these varieties is not available. Among others, this is a problem for growers of green house vegetables such as tomatoes and sweet peppers.

Main issues of organic farmers (Contd...)

- The price of organically produced seed is unnecessarily high, partly due to the limited number of market players (seed companies).
- The higher price of organically produced seed cannot (yet) be passed on to the consumers therefore organic growers have to sacrifice part of their profits.
- Farmers who do not use organic seed are able to produce their crops at lower costs, leading to unfair competition.

Main issues of seed companies

- Organic seed production is difficult, pioneering work. For example, a seed company trying to meet market demands for 200 metric tonnes of spring wheat seed had to double its production area to produce 350 tonnes: the extra production is necessary as part of the harvest is of inferior quality and another part may be rejected because of root rot.
- It is too easy for farmers to obtain derogations, leaving seed companies with unsold stock.

Main issues of seed companies (Contd...)

- To avoid the use of (expensive) organic seed, farmers may misuse the database, and this could lead to great profit losses for seed producers. For example, when the Bejo seed company registered on the database on onion variety that used to be a non-treated seed variety popular with organic growers, many farmers tried to avoid the obligation to purchase the more expensive organic seed by switching to other onion varieties, for which organic seeds were not available.
- There is a serious lack of organic seed producers. Seed companies should be stimulated to participate.
- A level playing field for farmers is necessary

Plant breeding for organic farming

- Are the varieties used in conventional agriculture also suitable for use in organic management?
- What kind of specific traits should varieties used in organic agriculture have?
- The suitability of existing conventionally bred varieties for organic agriculture can be evaluated reliably only under organic conditions

- First varieties adapted to organic farmers should be selected much earlier since farmers cannot afford to wait for 10 or more years.
- By the opinion of plant breeders the breeding of field crops is necessary for organic farming.
- Organic farming systems should be supplied with varieties better adapted for the new conditions that arise due to the new approach to plant management.
- This includes a greater need for varieties contributing higher yield stability competitiveness against weeds; nutrient efficiency and tolerance to diseases are in the choice of variety of much higher importance than in traditional farming (Ruzgas, 2005; Skrabule, 2005; Tamm, 2005).
- Nevertheless the possible amounts of organic breeding will be limited to the little share of organic farming in total agriculture.

To satisfy better the needs of organic farmers for adapted varieties the following will be planned by the plant breeders:

- Testing the local and listed varieties under organic conditions
- Starting limited breeding programs for organic farming with selection of promising lines and breeding numbers from exiting germplasm
- Starting limited breeding programs for organic farming and development of new lines from special crosses (Ruzgas, 2005; Tamm, 2005).
- Exchange of the genetic material that is especially adapted to organic/low-input agriculture
- Development breeding procedures for organic farming
- Standardization of the market sets and exploration of traits important for organic farming.

ORGANIC VARIETY

Characteristics of varieties

- Main differences are related to yield stability, processing properties and root-system development.
- Definition of “appropriateness”, related to variety for organic farming, is not easy to state as it may involves different aspects, depending on perspective (producers, processor, trader etc.)

Recommendation for variety evaluation and testing in organic farming

- To evaluate variety appropriateness to organic farming conditions and consequently orient the choice of varieties that seed companies offer to the organic sector.
- To consider specific variety traits requested by organic farming systems in the test for variety inclusion into the registers of varieties.
- To keep record of the variety requested for derogation and make it public. It may be a useful instrument for seed producers' orientation.

Organic seed and Inorganic seed comparison

1. Definition

Inorganic seed

- Seeds produced using organic and inorganic inputs, and management practices

Organic seed

- Seeds that are produced by completely organic inputs and management practices

2. Breeding methods

Permitted methods

- Traditional breeding
- Hybridization
- *in vitro* fertilization
- Tissue culture

Prohibited methods

- Cell fusion
 - Micro and macro encapsulation and recombinant DNA technology including gene deletion, gene doubling, introduction of foreign gene and changing the position of gene

3. Provenance

- Place suitable for seed production

4. Land selection

- 3 years conversion period

5. Seed

- Organic seed

6. Pre sowing seed management

- Removal of ill-filled, immature, shrivelled, damaged, broken, off coloured, diseased and insect attacked seeds
- Size grading
- Upgrading
- Water floatation
- Egg floatation in rice

7. Pre-germinated/ sprouted seed

- Rice, groundnut and gourds

8. Dormancy breaking

- Physical methods, mechanical scarification, cold and hot water soaking

9. Pre sowing seed enhancement techniques

- Hydropriming
- Seed fortification
- Seed hardening
- Seed biopriming
- Soaking in extracts of botanicals
- Sand matrix priming

10. Seed pelleting

- Use of organics, botanicals and natural origin, biocontrol agents, biofertilizers

11. Seed colouring

- Nature dyes

12. Season

- Select correct and optimum season

13. Fertilizer management

- Biofertilizers
- Green manures
- Composted coir pith
- Vermicompost
- Oil cakes
- Bone and fish meals
- FYM
- Composted organic agricultural and animal wastes
- Cattle, buffalo, goat, sheep, pig, poultry manures
- Sewage and biogas slurry

14. Avoid growing indicator plants in deficient nutrient soil

• Deficient nutrient • Indicator plant

N, Ca : Cauliflower, cabbage

P : Rapeseed

K, Mg : Potato, cauliflower

Fe : Cabbage, cauliflower, oats, potato

Zn : Citrus, cereals, linseed

Cu : Wheat, oats

Mn : Oats, sugarbeet, potato

B : Sugarbeet, cauliflower

Mo : Cauliflower

15. Weeding

- Manual weeding
- Use of green herbicide

Weeds as green herbicide	Weeds to be controlled
<i>Polygonum oriental</i>	<i>Amaranthus spinosus</i> , <i>Cassia spp.</i>
<i>Amaranthus viridis</i>	<i>Echinocloa</i>
<i>Trianthema portulacastrum</i>	<i>Echinocloa</i> , <i>Boerhavia diffusa</i>
<i>Sorghum halapense</i>	<i>Setaria</i> , <i>Digitaria</i> , <i>Amaranthus</i>
<i>Euphorbia escula</i>	<i>Agropyran</i> , <i>Ambrosia</i> , <i>Digitaria</i>

16. Plant protection

Plant products: Neem dust, Neem oil, neem formulation NSKE, turmeric powder, Notchi leaf powder

Biopesticides: *Pseudomonas* (Bacteria), *Trichoderma* (Fungi), NPV virus, Pheromone traps

- Dusting of ash to vegetables
- Smoking in vegetables

17. Harvesting at correct time

18. Drying

- Hanging of unhusked maize cobs over the chulas in kitchen

19. Storage

- Treat with biopesticides
- Treat with botanical products like leaf and rhizome powder, oil, etc.,
- Treat with activated clay, red earth
- Dry to 8-10 % moisture
- Dry and cool climate

Organic standards in importing countries: Differences and similarities

Different kinds of standards

- **Regulations (voluntary or mandatory)**
- **Private sector standards**
- **Market standards of consumer preferences**

1. Terminology

US : 100 percent organic

- **‘Organic’ (>95% organic ingredients)**
- **‘Made with organic ingredients (75-95% organic ingredients)’**

EU :

- **‘Organic’ (>95% organic ingredients)**
- **‘Made with X % organic ingredients (70-95% organic ingredients)’**

2. Categories of production

- **EU:**

- **Unprocessed agricultural crop and livestock products**
- **Processed agricultural crop and livestock products**
- **Feed stuff**

- **US:**

- **Crops, livestock and other agricultural products**

- **Japan:**

- **Agriculture, marine and forest products**

3. Implementation

- **EU: 1992, Revised 20 times**
- **US: 21st October, 2002**
- **Japan: 1st April, 2002**

4. Conversion Period

- **US: Transition**
- **EU: Conversion**

4.i. Length of conversion period

- **US: 36 months; No exception mentioned**
- **EU and Japan: 2 years for annual crops and 3 years for perennial crops**
- **IFOAM: 12 months for annual crops and 18 months for perennial crops**

5. Approval inputs

- **US:** Natural is ok; synthetic not ok
- **EU and Japan:** All inputs needs positive listing

6. Manure

- **EU:** Has limitations on origin of manure. Not composted conventional manure originated from ‘extensive animal husbandry’; composted conventional manure from ‘factory farming’
- **US:** No limitation on origin of manure;
- **Japan:** All manure to be composted
- **IFOAM:** Composting not required

7. Seeds and planting materials

- **US, EU and IFOAM** : Basic requirement for organic seed and transplants. If not available in sufficient quantity and quality, a number of derogations are made
- **EU**: Until 31 December 2003, conventional untreated seeds may be used; If not available, use conventional treated seed
- **US**: Use conventional seeds if an equivalent organic seed is not available

8. Contamination

- **EU:** No regulation on contamination from outside
- **US:** Not contain prohibited substances at >5% of EPA tolerance

9. Environmental aspects

- **US:** Conservation of biodiversity
- **EU:** Environment
- **IFOAM:** Improvement of landscape and biodiversity
- **10. Social aspects**
- **US, EU and Japan:** Not mentioned

Organic seed : Source

Community Seed Bank: Definition

- Community seed banks, managed by the local communities, could be established at the village or community level to facilitate seed availability.
- The establishment of such seed banks must build upon traditional practice.
- Most small and marginal farmers are self sufficient in seeds of preferred cultivars and resort to seed exchange with neighboring farmers only following a drought or other emergencies.
- This ‘self-contained’ traditional seed system serves as a backup source of seed for the region or community.

Exchange mechanisms

- Various exchange mechanisms are practiced to exchange seed between individuals and include barter and exchange based on social obligations decided by the community.
- The practice is informal and varies between locations and is strongly influenced by cultural traditions and relationships.
- The horizontal seed networking among farmers in different communities is a traditional approach that ensures the availability of seeds.

Exchange mechanisms

- In Kolli hills, south India, which is known for its inter and intraspecific minor millet diversity, the seed system is characterized by local seed production, selection, storage, and exchange among local communities.
- One-tenth of the harvested quantity is normally stored as a seed material.
- Exchange takes place among relatives and neighbors and generally seed could be given to all.
- Repayment is a must and customary, sometimes motivating the farmer to revitalize the cultivation.
- Women play a dominant role in seed management and decision-making, and undertake all seed production activities.

Seed exchange network in villages



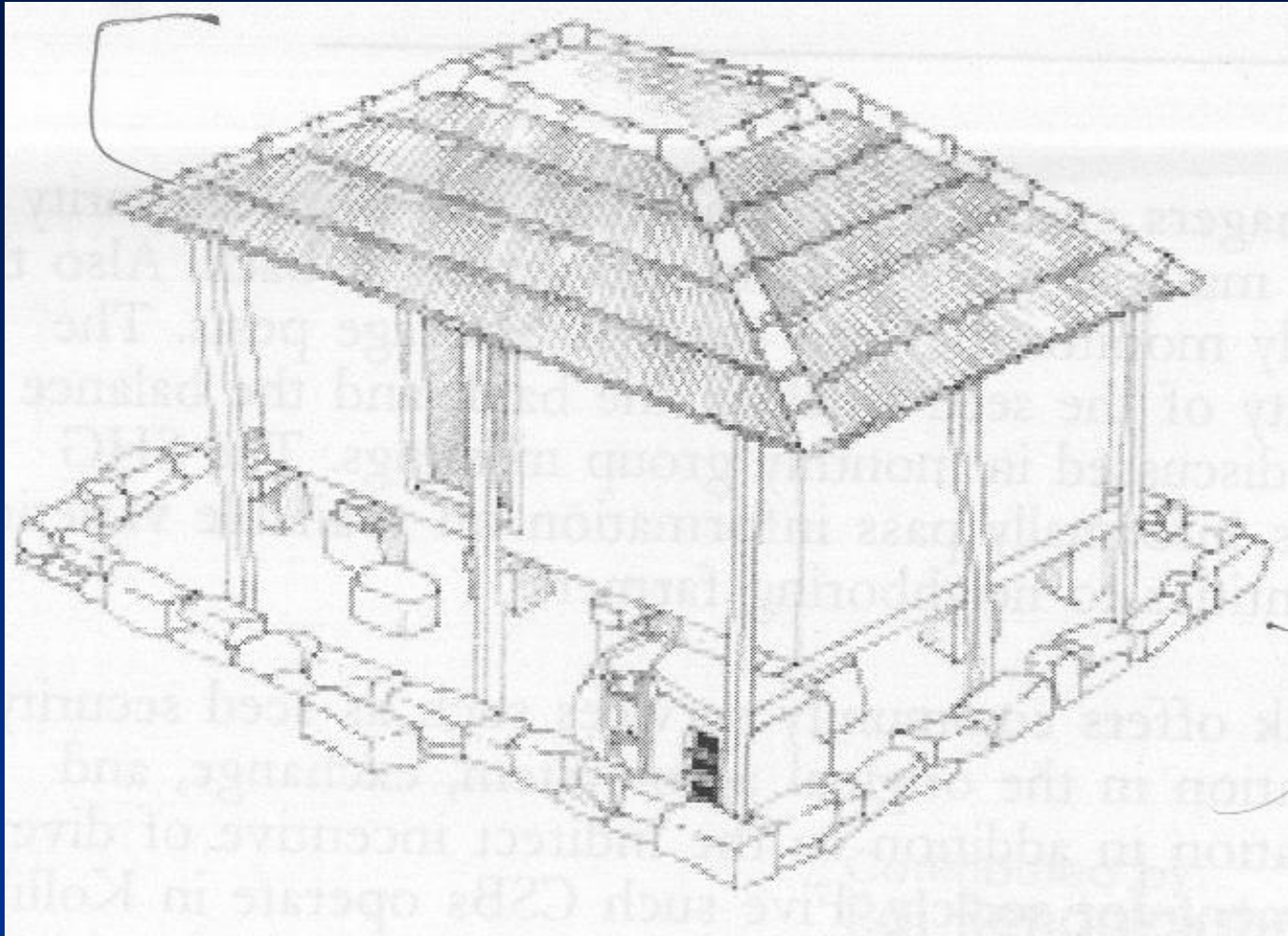
Objectives of community seed bank

1. Ensure the sustainable supply of required planting materials
2. Serve as a community based *ex situ* conservation facility and as a backup source and
3. Enhance the access and availability of locally adapted crops and their varieties

Self help group

- Consisting of 10-15 women and men farmers, manages the unit.
- The SHGs are primarily credit-based institutions that are recognized by the formal banking system.
- Two selected women from the group serve as seed bank managers.
- Necessary training and capacity building programs are organized periodically, essentially focused on seed quality, monitoring, storage and management.

Seed storage



- ‘Thombai’, a traditional grain storage structure built with red soil, paddy / wild grass straw, and wood. The size of the structure is 5” x 9” with a capacity of 500-900 kg of seed material.

THANK YOU