
Applying Biodynamics in Organic Seed System

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This material aims to give a broad introduction to biodynamics and organic agriculture matters as applied to seed system. It is a work in progress. Readers' comments are very much welcome.

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I. Biodynamic Agriculture, Defined

Biodynamic Agriculture is an advanced organic farming system that is gaining increased attention for its emphasis on food quality and soil health. Among the many tested models of agriculture, biodynamic agriculture has taken highest prominence in the development of international principles and standards. There is a wide body of knowledge and scientific research proving the soundness of biodynamic principles.

Biodynamic or biodynamics as a term is derived from the Latin word “bios” for life and “dynamis” or “dynamic” for force. It grew out of the anthroposophic philosophy (science of spirit) of Rudolf Steiner in 1924. Steiner is Austrian born scientist and philosopher. Anthroposophy is an approach to science, which integrates precise observation in natural phenomena, clear thinking, and knowledge of the spirit. It offers an account of the spiritual history of the earth as a living entity, and describes the evolution of the constitution of humanity and the kingdoms of nature. Biodynamics is a science of life forces, in recognition of the basic principles at work in nature, and an approach to agriculture, which takes these principles into account to bring about balanced healing. As such, Biodynamics is an ongoing path of knowledge rather than an assemblage of methods and techniques.

Today biodynamic agriculture is practiced on farms around the world, on various scales, and in variety of climates and cultures. However, most biodynamic farms are located in Europe, the United States, Australia and New Zealand.

II. Goal and Approaches

The goal of a Biodynamic farming is to be able to support just the right balance of people, plants and animals, so that no outside inputs such as soil amendments or feed for the animals is needed, thus developing a farm that is far as possible an independent entity. This is done by careful timing of planting, weeding, fertilizing and harvesting to coincide with the lunar and celestial phases which will most enhance the farm output. Specially made compost consisting of time-tested doses of plants, minerals and animal manure is applied throughout the seasons to enhance soil fertility and plant vitality.

III. Origin of Biodynamics

Biodynamics is the oldest certified ecological farming system and has been an assurance of quality since its birth in 1928. When asked why the world was in so much turmoil and why people did not seem able to make moral and productive decisions necessary for positive change, Rudolf Steiner responded that our food lacked the etheric life forces to support our WILL. Steiner believed that the quality of food needed to improve for people to have enough WILL to be capable of making choices that would lead to a harmonious relationship with nature.

The system of sustainable and regenerative agriculture known as Biodynamics began in the 1920's and was modeled around the agricultural lectures given by Steiner. Following the introduction of chemical fertilizers, farmers during this period were noticing that depleted soil and diminished quality of crops and livestock were becoming serious problems. They turned to Rudolf Steiner for solutions. Out of this concern and Steiner's subsequent lecture series, the first ecological farming system was developed.

IV. Principles of Biodynamics

A basic ecological principle of biodynamics is to conceive the farm as an organism, a self-confined entity. A farm is said to have its own individuality. Emphasis is placed on the integration of crops and livestock, recycling of nutrients, maintenance of soil, and the health and well being of crops and animals; the farmers are integral part of the whole. This philosophy suggests that humans, animals, plants, minerals and the cosmic periphery form a whole system, or organism. The farm organism forms a unity in regard to the workings of both human and natural systems. The root of biodynamic system is the relationship of the farmer and his or her practices to the local ecosystem, which in biodynamics reaches the extent of including the influence of the cosmos and subtle life forces on local habitats. Thinking about the interactions within the farm ecosystem naturally leads to a series of holistic management practices that address the environmental, social, and financial aspects of the farm.

A fundamental principle of biodynamic agriculture is that food raised biodynamically is nutritionally superior and tastes better than foods produced by conventional methods.

The life energies from food allow human beings to go on with spiritual development. These life energies provide the necessary bridge between the inner mortal and spiritual intentions and the actual behavior of human beings.

With increasing use of chemicals, people's food was not only less nutritious and more toxic. They also had lesser amounts of life energies essential for the continued health and spiritual growth of human beings.

To note that in biodynamic agriculture plants are worked on according to their physical and etheric (or life force) realm, while animals including so called pests (insects, rats, etc.) are managed on their astral realm. Human beings integrate these forces of the physical, etheric and astral (which he also shares with) in his thinking/spiritual realm to have a successful production system.

V. Features of Biodynamics

Biodynamic farming is a system of farming that seeks to integrate cosmological with terrestrial environment, to bring nature again with the cosmic creative shaping forces. It is closest to Natural Farming (or do nothing farming), the highest form of farming, in the spectrum of sustainable approaches (by Hill, 1989). Its main principles or features are the following:

1. *Farming in accordance with a broader cosmological and terrestrial environment.*

Farming decisions are based on the lunar rhythms (e.g., waxing and waning, ascending and descending, apogee and perigee). Planetary and zodiac influences, appearance and positions of constellations are likewise basic in biodynamic farming.

2. *Crops express the interrelationship between terrestrial energies and forces emanating from the cosmos.*

A plant is believed to act as mediator between earth, warmth, water, and light. It "crystallizes" into its own body the light form force of the sun and brings it down deep into the soil, thus structuring the soil. Plant forms are believed to be influenced by the sun, moon and planets such that they take on the traits attributed to a planet (e.g., the oak trees are considered an influence

of Jupiter (God-like) while creepers or vines are influenced by Mercury (which spirals round and round).

The energy of the sun, moon, planets and stars reaches the plants in regular rhythms. Each contributes to the life, growth and form of the plant. By understanding the gesture and effect of each rhythm, one can time ground preparation, sowing, cultivating and harvesting to the advantage of the crops being raised. The *Stella Natura* and the Northern Star calendars offer an introduction to this field.

3. *Soil is viewed as a living system.*

Biodynamic farming recognizes that soil itself can be alive and this vitality supports and affects the quality and health of plants that grow in it. The humus and the degree of compost digestion are very important. The soil receive the light form force of the sun through the plant that “crystallized” this force into its own body.

4. *Life force can be enriched through the use of biodynamic preparations.*

Biodynamic farmers use nine BD preparations (Table 1) to manage the life forces in both the soil and the plants. These are applied on the compost or the plant, while they are equivalent to the homeopathic preparations and applications given to people and animals.

Timely applications revitalize the weakened life forces and stimulate root growth, soil microorganism production and humus formation. The BD preparations work together with the farmer to ensure the abundant, productive and fruitful growth and development of crops in the farmers’ fields.

VI. Biodynamic (BD) Preparations

Tilling the soil or removing a crop exploits the land through the breakdown of organic substances and the removal of minerals. Commonly recognized organic practices and fertilizers are used to correct this problem. However, what is more important and that is often overlooked is the depletion of the subtle life forces that are also needed to sustain biological functioning. These forces need to be replenished in the soil and in the air above the earth’s surface.

There are several ways to strengthen the life forces. In biodynamic agriculture, preparations are made from herbs, mineral substances and animal manures to be applied to soil and plants at very small rates, measured in parts per million. Biodynamic preparations are one means to manage the “formative life forces” that abound in the farm. The BD preparations balance the flow and interaction of life energies that make all life grow and flourish. Some BD preparations dampen an over abundance of life energies in the wrong place.

All in all, the three groupings of biodynamic preparations are: a) the compost preparations; b) the spray preparations; and c) BD 508.

In agriculture, Steiner’s fundamental premise is that the earth cannot be vitalized by merely adding chemicals or minerals. Organic matter must first be “spiritualized” and vitalized by cosmic forces before it can in turn organize and vitalize the earth. BD preparations are considered potentized with cosmic forces, bringing life back to the soil.

Box 1. Biodynamic preparations, representations, sources and functions.

Preparation and Representation	Source (Plant Part)	Process	Function(s)
500(Earth)	Cow manure	Cow manure buried in cow horn during winter	Serves to relieve plants of stress; promotes root activity especially of fine root hairs to stimulate soil micro-life and increase beneficial bacterial growth; invigorates the soil
501(Sun)	Quartz	Quartz crystals buried in cow horn for several months	Helps bring sunlight to the leaves; stimulates fruit and seed formation; improves the flavor, keeping quality nutritional value of crops as well as making them resistant to diseases and pests
502(Venus)	Yarrow (blossoms) (<i>Archillea millefolium</i>)	Blossom are buried for a year in a bladder of a stag.	Regulates potash process with the help of sulfur; allows plant to take up the proper trace elements essential for growth and seed formation
503(Mercury)	Chamomile (blossoms) (<i>Chamomilla officinalis</i>)	Chamomile buried in cow's intestine	Aids in stabilizing the nitrogen content of plants; helps the plant to find the right relationship between silica and potassium, enabling the soil to take in the right amount of silica from the atmosphere and from its cosmic surroundings
504(Mars)	Stinging nettle(Whole shoot in bloom) (<i>Urtica dioica</i>)	Buried for a year or more	Regulates potassium, calcium and iron with the help of sulfur; makes manure inwardly sentient and sensitive; makes the earth itself intelligent and permeates it with reason; soil individualizes itself and allows proper relationship between soil and specific plants; enhances vegetative growth of plants, especially during the dry weather
505(Jupiter)	Oak (bark) (<i>Quercus robur</i>)	Buried in skull of a domestic animal	Calcium regulation; helps control plant diseases
506(Jupiter)	Dandelion (flowers) (<i>Taraxacum officinale</i>)	Buried in cow's mesentry (stomach)	Stimulates transmutation of chemical elements; helps regulate cosmic influences; helps regulate the formative life energies coming from the cosmos
507(Saturn)	Valerian (flowers) (<i>Valeriana officinales</i>)	Extract juice	Regulates phosphorus process; aids in the compost fermentation process
508 (with the cometary forces)	Horsetail (<i>Equisetum arvense</i>)		Prevents rust and other fungal diseases; can be used as spray against mildew, rust, scab, and other soil-borne pathogenic fungi; improves protein content and ratio of vitamin C in plants

VII. Biodynamic Practices

The principles of biodynamics have been practiced all over the world. It is akin to those practiced by indigenous farmers although their awareness of the similarities may not be there. Farming with biodynamics requires a sacred heart to have wisdom and knowledge in effective farming.

A. Biodiverse Cropping System

Like organic farming, biodynamic farming also promotes biological diversity. Different types of crops bearing products from the root, leaf, flower and fruit are planted in the same area. Animals are integrated in the farm. Crop rotation or sequencing is also practiced as part of biodiversity for farming system. Planting of crops is based on the BD sowing calendar that is based on the lunar and zodiac influences. Diversity of crops reduces insect damage and disease infestation and increases land productivity. Nutrient cycling is promoted by the different nutrient pumping levels of the plants depending on the depth of its roots in composting is integral in the process. Diversity also balances the different energy since different plants are governed by certain dominating cosmic forces such that the presence of the other balances the whole system.

The following are some of the biodynamic practices that enhance diversity:

1. *Choice of crops and varieties.* Species and varieties cultivated should, as far as possible, be resistant to pests and diseases, tolerant to adverse climatic conditions and adaptable to soil and general environmental conditions. Local crops and varieties are far superior to imported or exotic ones.
2. Organic seeds and plant materials used should be from certified organic

production or from the same farm. Seeds to be planted should be produced organically - free from chemical fertilizers and pesticides and grown biodynamically in the area for at least two years. Species is important but within species cropping should also involve several varieties or cultivars (genetic diversity). When certified organic seeds and plant materials are not available, chemically untreated conventional materials may be used for a start.

3. *Genetic diversity.* Multi-cropping and the integration of different crops and different varieties in the fields prevent genetic erosion and control pests and diseases infestation.

B. Improvement of Soil Health and Productivity

Soil is the key factor in the maintaining the health of the plant. Soil is considered living and therefore fed with humus. Enhancing soil health and productivity includes composting, green manuring, crop rotation and mulching. Chemical fertilizers destroy the life and other properties of the soil.

Composting is done with the plant residues found in the farm. BD preparations (502-507) are used to enhance decomposition and to incorporate the cosmic and elemental forces. Such BD preparations are made more active by stirring them, in water to form a vortex, simulating the form of natural forces and cosmic movement. The compost also improves soil structure, aeration, water holding capacity, and cation exchange capacity. It increases organic matter content of the soil and promotes activities and proliferation of soil microorganisms.

C. Crop Protection

1. *Insect pests and diseases*

Soil management is the key factor in establishing and maintaining a healthy plant, which can resist pests and diseases. Balanced nutrition and energies are supplied to the plants.

Crop selection is also critical in crop protection. Traditional, indigenous or local seeds are used and not “modern” or hybrid seeds which do not have sufficient life force, are unadapted, require heavy chemical inputs and lead to genetic erosion. Appropriate cropping system supports healthy soil and produces healthy plants that are able to ward off pests if not tolerate or resist pest attacks. Synchronous planting and crop rotation are effective ways to control pest population.

The use of pesticides is avoided. Pesticides bring health hazards, kill beneficial insects and cause pest resistance. Health is enhanced with the BD preparations. For example BD 508 is sprayed to prevent mildew and rusts. When pests are in uncontrollable proportion, ashing (of own kind) may be done and applied like a BD or

homeopathic preparation (super-diluted proportion). Milk and honey may also be explored as a way to invite natural enemies.

2. *Weeds*

Weeds are not viewed as noxious plants. Their benefits outweigh their disadvantage. They become nuisance only under unecological system of farming. Weed plants prevent soil erosion, can be a host to some beneficial insects and used as compost. Weed seeds are also used for its own control by ashing and being scattered in the area to control the same kind of weeds. Plants that are conventionally considered weeds are actually used in BD preparations (Box 1).

3. *Other pests*

Conventionally, considered pests such as rodents may be managed according to their nature. To know are their behavior given certain cosmic phenomena. The right cropping system has great influence on their proportion but ashing could also be tried. The farmer could also do other means, and this applies to insects and other animal pests, through some kind of offering or deal. This approach works on their astral nature.

Box 2. The Difference between Organic Farming and Biodynamic Agriculture

Organic and biodynamic farming use whatever sound methods can be borrowed from conventional agriculture. Both also rely on the science of ecology and respect the wisdom and practices of indigenous farmers.

Many organic farmers, however, lack the understanding of life. Many still share the unproven belief of chemical farmers that life is simply chemical or that farming is only through inputs management. Biodynamic on the other hand, has developed many scientific approaches to study the non-material, spiritual properties of life. It has also expanded the meaning of ecology to include exploring and working with stellar and planetary cosmic forces that nurture the growth, quality, and nutritional value of food crops.

Biodynamics parallels organic farming in many ways – especially with regard to cultural and biological farming practices – but it is set apart from another organic agriculture systems by its association with the spiritual science of anthroposophy founded by Steiner, and its emphasis on farming practices intended to achieve balance between the physical and higher, non-physical realms; to acknowledge the influence of cosmic and terrestrial forces; and to enrich the farm, its products, and its inhabitants with life energy.

The International Federation of Organic Agriculture Movement (IFOAM) has adopted many of the practices and principles of BD Agriculture. Otherwise, organic can simply deal with inputs and benign management system.

Plain organic (non-biodynamic) farmers may also apply the above practices, but do not apply BD preparations nor use the BD calendar. They also may not share with the framework that the farmer is an essential element of the farm ecosystem and has the spiritual role to integrate his farm with the earth's total healing.

VIII. Organic Seed Practices with some Biodynamics

A. The following are abstracted from various articles:

- Scope. Organic seed production can broadly touch on disciplines or steps before and after seed production/multiplication. Current standards of being organic adapted biodynamic practices. Local or indigenous seeds maybe considered organic and many are highly similar in features to biodynamic farming.
- Performance. Seeds from BD farming have been shown to have better storability than organic seeds and much more than conventionally produced ones. Organically grown produce, in general, have been found to have higher levels of nutrients when compared with conventional produce (according to a research in University of Copenhagen). Organic crops have a higher concentration of vitamins and far more secondary metabolites, which are naturally occurring compounds that help immunize plants from external attack. Some of these are thought to lower risk of cancer and heart disease in humans.
- BD Practices in Seed Production. Plant development corresponds to the four elements (earth, water, light and warmth). These elements affect the development of certain crops differently. Earth largely influences the development of roots; water, the leaves; light influences the development of flowers; and warmth, the development of fruits/seeds. The zodiac signs also have bearing on the four elements. The earth (represented by Taurus, Virgo and Capricorn) influences the development of roots; water (Pisces, Cancer and Scorpio) - the leaves; light (Gemini, Libra, Aquarius) - the flowers; and warmth

(Aries, Leo, Sagitarius) - the fruit and seed.

- Seed soaking and seed sowing
 - *The moon swings around the earth in an elliptical orbit. When the moon is nearest the earth which is, perigree or “winter moon”, seeds that are planted at that time are vulnerable to pests and fungus diseases. Thus, it is not advisable to sow during the “winter moon”. Sowing two days before the full moon produces a good and bountiful harvest.*
 - *In sowing seeds (even for direct seeding in the garden or field), seeds are soaked with water and biodynamic preparation as near to the time of planting as possible. Seed soaking in water and BD preparation helps the seeds/tubers to wake up to the forces of the lunar events.*
 - *In Don Bosco Diocesan Youth Center in North Cotabato (an NGO promoting biodynamic farming), the use of indigenous microorganisms (such as fermented juices in Korean Nature Farming) as seed soaks are being studied.*
- Soil preparation and weed control
 - *In soil preparation, it is best to cultivate when the moon is in Leo (lion) to stimulate the greater weed germination and follow with final seedbed cultivation when the moon in Capricorn (goat). If one consistently follows the pattern, weed problems would be greatly diminished.*
 - *In preventing weeds, seeds of the weeds are ashed preferably just before a new moon or a full moon. The ashes are scattered over the area where there is weed abundance.*

- Planting/Transplanting

- *The strength of lunar influence increases as it goes towards full moon. During an ascending moon, there is a strong upward flow of plant forces and the sap. This can also be explained by the moon's gravitational pull of water. At this time, farm activities such as pruning, cutting or clipping hedges are not advisable because the plant would tend to bleed.*
- *Root crops are planted when the moon rises over Taurus, Virgo, or Capricorn; leafy vegetable when Pisces, Cancer or Scorpio dominates; flowers are planted when Gemini, Libra or Aquarius dominate. Fruits are planted when Aries, Leo or Sagittarius dominate. Seeds are best transplanted during a fruit day.*
- *Seeds are best planted during a fruit day.*
- *In February and March of every year, the peak ascension will precede full moon by a few days to week, crops planted, for example onion, at peak ascension rather than full moon show greater vigor and quicker seedling growth.*
- *Best time for planting is just after the EQUINOX (April 21), the meeting of the sun and the moon (during the month of April-May).*
- *Planting is best done when there is a high energy but pruning should be done during low energy (after full moon). Infestation of pest is observed if planting is done under full moon, hence, planting must be done after full moon.*
- *A descending moon is favorable for transplanting when the plant tends to*

orient itself towards the roots and form rootlets quickly. It is also the best time to do manuring and composting.

- Harvest and Storage

- *Harvesting time may have impact on storage. For instance, bamboos harvested during full moon are susceptible to rotting due to its high starch content during this period.*
- *Seeds must be harvested in a fruit day.*
- *Full moon tends to result to high tissue moisture content thus poor storability of crop produce.*
- *Harvesting root crops is best when the lunar influence is towards the underground plant organs (descending moon).*
- *For vegetable seeds, wood ash is used for storage. Ashing weevils and applying on stored seed could be tried.*

- Purification/Selection/Adaptation

- *Biodynamics breeding may consider purification using the 4 elements. Adaptation to or use of these elements can generate new genotypes out of the old by simply planting them in these environments.*
- *See section VIII for excerpts on biodynamic breeding.*

B. Adapted from Bio-dynamic Farming Practice (Sattler & Wistinghausen, 1992)

1. Seed and seed sowing techniques

a. Choice of variety

- Run trials in different localities for at least three years before useful information on its inherent qualities is obtained
- The variety may be deemed vital if it is: a) resistant to poor growing conditions, and b) adaptable to variable conditions.
- Do inspection walks so as to assess the usefulness of individual varieties.
- Modern varieties broad, long and robust two uppermost leaves. Light utilization is improved by having the leaf more horizontal to the stem.
- Horn silica application may be effective partly due to improved assimilation; horn manure and biodynamic seed baths encourage root development.
- The application of horn silica makes leaves surface area more exposed to light as it follows the movement of the sun.

b. Growing quality seed

- Carefully observe and judge the quality of crops and individual plants.
- Familiarize the growth rhythms and special needs of crops and their companion herbs and grasses. This means that farmers must develop an inner relationship to the plant world, as well as in breeding and animal-keeping.

c. Sowing times

- Cereals sown close to the winter months produce seeds with high reproductive power. Sowing closer to the summer season tends to enhance the nutritive value.
- Sow winter crops later and spring crops earlier to obtain healthy seed with high growth and yield performance.
- Nutritive quality is enhanced by tilling the soil and sowing food and fodder crops closer to the summer months, i.e.

earlier for winter crops and later for spring crops

- When plants have grown for seed close to winter for two years, the next sowing must be at the 'normal' time, or even a little closer to summer, to avoid one-sided development.
- Save some seeds for the subsequent seasons to avoid losing a variety that has proved successful on the farm; this can be used if the new harvest has poor germinating power and does not produce useful seed.

d. Choice of growing site

- Crops grown for seed are best included in the existing cropping sequence. If several sequences are used on the farm, choose the field where the interval for the same crop is the longest.
- Seeds are better grown in the middle of the field (as opposed to the extremely rich or poor condition, headlands and marginal strips) while the rest of the field may be used to grow the same crop for food or fodder in the usual way.
- Marker posts and good seed bed preparation allow drilling close to the winter season even if there is light snow cover, taking account of relevant astronomical data.
- Areas selected for seed growing are either not fertilized at all or given just a small amount of well rotted or humified manure (12-16 tons/ha); they should not be given rich manures that would force growth.

e. In-field selection

- 'Positive mass selection' consists in selecting strong healthy specimens spaced at regular intervals, i.e. with no gaps between them or as solitary plants.
- Ears and panicles should be filled with well-developed grain, including base and tip.
- Preselection is done during the active growth period, taking special account

of leaf and culm development and using stakes to mark selected specimens.

- Final selection based on the above criteria is made shortly before the whole field is harvested.
- The selected ears and panicles are cut off below the uppermost node in the case of rye, wheat and oats, and at the second highest node in the case of barley.
- The aforementioned provides the basic seed; it must be dried with care and stored in a separate place, to be grown in a separate field during the next season and provide basis for subsequent food and fodder crops.
- 'Negative mass selection' involves the careful removal of all abnormal and atypical specimens and all plants of different species from the field selected for seed growing.
- Clean seeds are sorted by hand every three or four years during winter, discarding all abnormal, damaged and discolored seed as well as seed from other species.
- Although laborious, such intense involvement with plant nature will

develop completely new relationships, capabilities and powers.

- In a regional scale, individual farm communities may each take responsibility for a particular crop in which they have a special interest and which suits their particular site.

f. Seed baths

- Seed baths enhance plant growth by hastening germination (due to moisture uptake).
- Legumes have been found to produce greater number of nodules, thus greater activity from nitrogen-fixing bacteria living in symbiosis with leguminous plants.
- Crop exposed to seed baths have healthier and better yields, can cope better with poor weather conditions and develop a stronger and more extensive root system.
- Seed baths, with the use of appropriate extracts are done the day before sowing (see Box 3).

Box 3. Seed Bath Preparations

PREPARATION	INSTRUCTION
Horn manure	<ul style="list-style-type: none"> ▪ Stir for 1 hour immediately before use. ▪ Use for spinach.
Valerian preparation	<ul style="list-style-type: none"> ▪ Stir for 15 minutes before use, a tablespoonful of warm water. ▪ Use for wheat, fodder beet, leeks, onions, tomatoes, celeriac, potatoes.
Birch pit concentrate	<ul style="list-style-type: none"> ▪ 1 part + 4 parts rain water + 5 parts whole milk; stir vigorously for 5 minutes, leave to stand for 20-24 hours, stir another 5 minutes before use. ▪ Use for fodder and sugar beet, carrots, potatoes (made up without milk).
Yarrow preparation	<ul style="list-style-type: none"> ▪ Stir 1 portion (c. 1-2 ml) in 3 liters of hand-warm rain water vigorously for about 5 minutes, leave to stand for 20-24 hours (an occasional stir helps); stir briefly before use. ▪ Use rye, grass seed.
Wild chamomile preparation	<ul style="list-style-type: none"> ▪ As for yarrow. ▪ Use for legumes, radishes, rape, mustard, tulips, cabbage varieties.
Nettle preparation	<ul style="list-style-type: none"> ▪ As for yarrow. ▪ Use for barley.
Oak bark preparation	<ul style="list-style-type: none"> ▪ As for yarrow. ▪ Use for oats, lettuce, potatoes, dahlias.

- Cereal and legume seeds will need two to three litres per 100 kg. Using a hand-brush, or knapsack sprayer for larger amount, turning it three times with a shovel in the process. Cover with sacks and leave for two hours. The small amount of moisture will distribute itself evenly through the heap in this time. Spread it out dry, so that there will be no problems with the drilling machine, and turn once more if necessary.
- Put smaller amounts into fabric bags and suspend in the liquid for 15-20 minutes; dry in a shady place before sowing. Seeds of row crops require two hours' soaking.
- Seed potatoes are also sprayed, turning the heap at the same time, but this is done three times in two weeks.
- Birch concentrate will improve the quantitative yield, while valerian gives better resistance to degenerative diseases and late blight (*Phytophthora infestans*).
- All bathed seeds and plant materials must be sown or planted within two days.
- Seed bath treatment gives farmers opportunity to give the powers of their heart to the seed, letting a stream of forces enter into plant development.
- In autumn, the share should not go below 0.5-1 cm, whereas 3-4 cm is advisable in spring.
- Spring hoeing will stimulate further weeds into germination, so that winter crops may be contaminated with typical summer crop weeds and grasses unless further hoeing operations are done. These should be shallow to avoid damage to superficial roots (for temperate areas). May try such methodology if applicable for tropical areas.
- There is an earthing-up effect. This does not really matter with cereals but can be a disadvantage for a following ley, as uneven ground makes mowing more difficult.
- If the share is 10-12 cm wide, the distance between cereal rows should be about 18-20 cm.
- With an effective width of 2.5 meters the time required to hoe one hectare is about 3 hours for the first to pass. About 2 hours should be considered for subsequent passes.
- Hoeing also has a positive effect on soil structure; it stimulates mineralization and reduces evaporation.

2. Post drilling cultivations

Mechanical hoes are used on routine basis on row crops or vegetables - e.g. potatoes, beet, maize and carrots as well as in cereals. Mechanical hoes can be used until the plants close up or shoot development starts; it is contraindicated only if wheel tracks are clearly causing damage in rainy weather.

The following points are to be considered when working with mechanical hoes:

- Both annual and perennial weeds are attacked.
- The method can be used for a relatively long part of the period of active growth.

3. Farming techniques that have biodynamic concepts in some arable crops:

a. Potatoes (*Solanum tuberosum*)

It is known that special eating habits have a marked effect on inner development in humans ('you are what you eat'). A diet with a high proportion of meat tends to encourage aggressive tendencies but also heroism and courage. A vegetarian diet usually results in more gentle behavior but may also lead to fanatical propaganda for specific life styles. Potatoes as a stem element growing in root region address mainly the nerves and senses, especially the midbrain. An almost exclusive diet of potatoes prepares the ground for materialistic ideas and actions (from Rudolf Steiner, lecture given in Dornach, Switzerland, on 22 September 1923).

Unlike plants that have more of the nature of light in them, above all the cereals, potatoes produce lush vegetative growth, usually a dark green, of the kind normally only seen in plants that grow in the shade. They respond quite definitely to intense use of the biodynamic field sprays, especially horn silica, the light mediator.

The real cause of degeneration of potatoes other than susceptibility to diseases is probably the consistent omission of the sexual phase, i.e. growing the potatoes by vegetative propagation for generations.

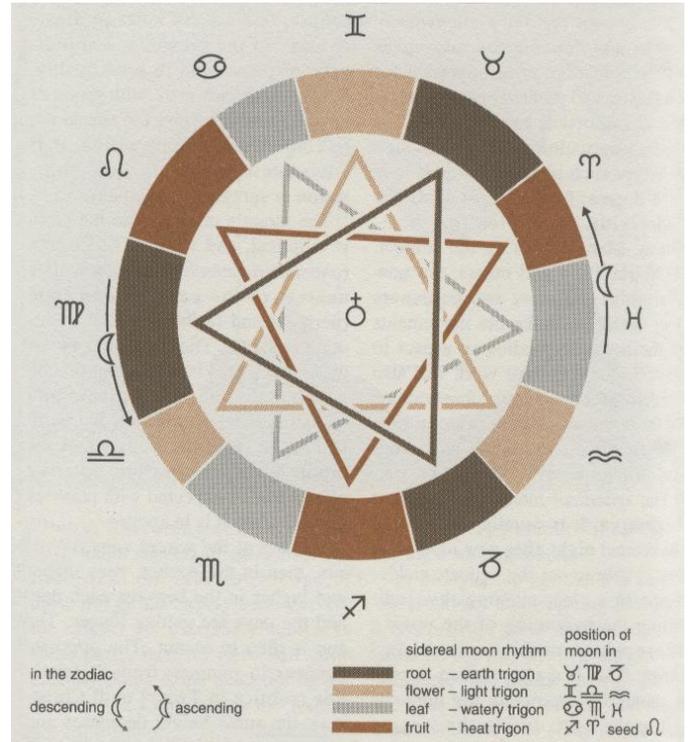
The potato is an annual. The true seed produces remarkably delicate small plants with a single shoot and relatively vigorous root growth, developing tubers the size of hazelnuts. It needs two years of vegetative propagation to produce potato haulms and tubers of normal size. With vegetative propagation, the reserves of the parent tuber give rise to vigorous young plants with multiple shoots and a limited root system. Healthy planting material can be obtained by growing potatoes from true seed.

Asked what could be done to improve the regenerative powers of potatoes, Rudolf Steiner told Ernst Stegemann to use a special chitting technique: Mark plants in the field that show healthy, vigorous growth. Harvest them separately (plant selection). Discard any tubers that are bad or show rot and store the rest in a separate clamp or place. Three or four weeks before the ideal planting date, the eyes are cut. Use only fully developed single eyes that are well apart from others and have not yet started to sprout. Cut off the heel and rose ends of the potato. Leave only the minimum tissue around the eye, but not to damage the bud as this would increase susceptibility to black leg (*Rhizoctonia solani*). Wedge-shaped sections with the bud at the wider end are the best.

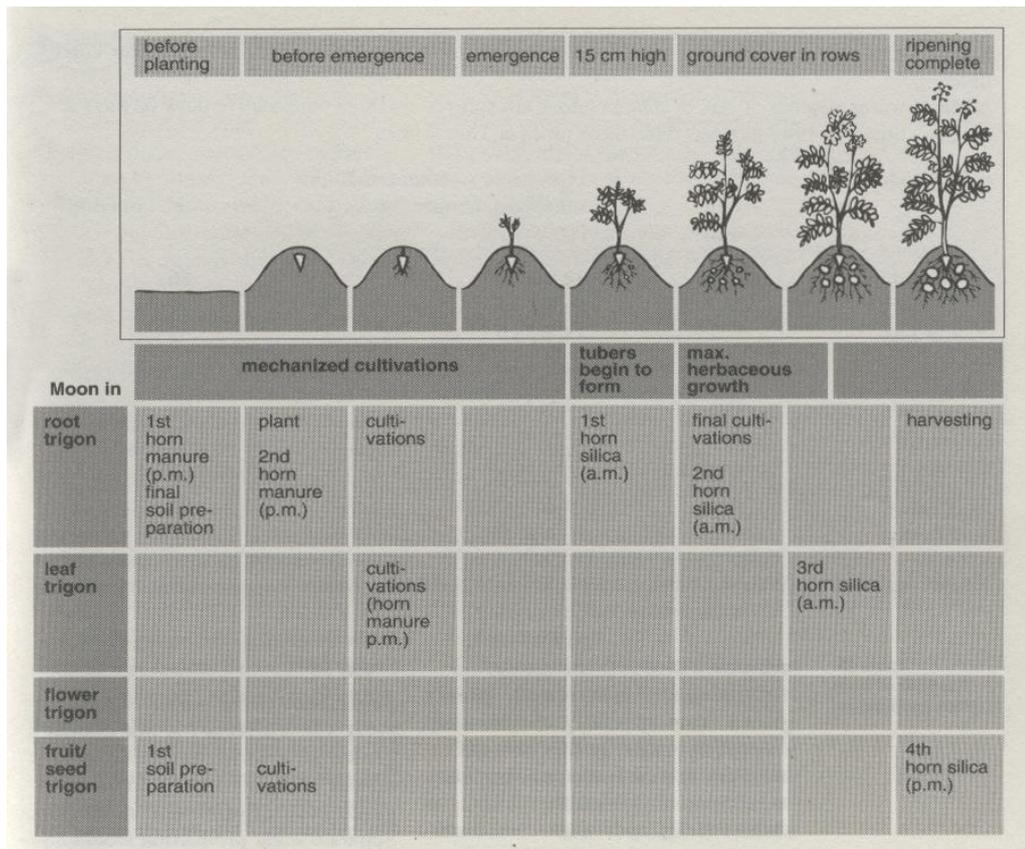
The first seed bath is given for 14 days, 2nd at 7 days and the 3rd is given 2 days before the planned planting date. Valerian and oak bark are more effective with chitted potatoes than birch pit concentrate. Keeping the potato material moist for the week preceding planting will stimulate root growth.

Dynamic measures. One-sided trends develop if all soil preparation, planting, cultivation, and spraying (to stimulate root and tuber development) are done at a root trigon, as determined by the relative positions of moon and zodiac (see figure).

Sidereal moon rhythm. The four trigons in the zodiac that act on root, leaf, flower and fruit. Based on the work of Maria Thun.



Sample cultivation schedule for potato.



It is recommended that operations are not limited on root days but also work at leaf trigons during the main period of foliage growth (horn silica sprayed in the morning, hoeing and ridging) and at seed and fruit trigons to support the ripening process (horn silica in the afternoon).

The valerian preparation is better on heavy soils, while the oak bark is preferred if there is high risk of degeneration and fungus attack. It is also recommended to apply seed baths during root trigons. A single application of horn manure can encourage the prolific growth of potatoes. Potatoes respond well to frequent applications of horn silica.

In sudden extreme weather changes, e.g. from hot and dry to damp and warm, horn silica is applied for 3 consecutive days to give good results. On the other hand, the application of horsetail tea for 3 consecutive days in wet and dry fields helps prevent fungus attacks. Hence, biodynamic field sprays should not be regarded as direct control measures for these have indirect effect by strengthening crops and making them unattractive to pests and diseases.

Harvest. Potatoes should only be harvested when they are fully ripe. In some varieties, ripeness may coincide with the withering of the leaves.

Potatoes harvested during the root trigon normally keep better, store better and show better dormancy. However, if physiological maturity, dry soil and weather conditions are met, it is not advisable to wait for the favorable moon position at this late season.

After harvest, potatoes are left to rest and dry for one or two weeks before they are sorted and put into storage.

b. Stinging nettle (*Urtica dioica*)

Generally considered a weed today, the stinging nettle was widely used as a human and veterinary medicine in the past. Nowadays, its fresh plant, nettle juice, dried herb, and alcoholic extracts can also be used:

- in medicated feed
- for rearing young stock, especially poultry
- as an additive to dung liquor and compost production
- as plant liquor to overcome setbacks in crops and for pest control
- to produce the biodynamic preparation
- in natural medicine and
- as a health food or vegetable

Stinging nettle is perennial and its flowers are generally unisexual and on separate plants. It would be difficult to find sites and conditions where the stinging nettle does not manage to grow. It also seems to have a particular affinity for human habitations, always growing in the immediate vicinity. Transitional sites are preferred, e.g. the edges of woods, hedgerows, fences, among old buildings and unused machinery, on the banks of streams and ditches, in rubbish dumps and soils rich in nitrogen.

It is easier to propagate nettles in root sections, mature stolons or rhizomes (from relatively large crops), as opposed to germinating seeds since it requires temperature levels below zero.

Nettles are highly sensitive to compacted soil and to the pressure from farm machineries (e.g. farm tractors). It can be harvested during the dry season wherein fresh shoots maybe eaten as vegetable and used to make tea and juice. When the leaves are fully developed, it can be used for medicinal use. The flowering plant is dried for medicated feed and used to make biodynamic preparations. Depending on the site and weather conditions, two to three

cuts can be made in a year. Nettles lose their vigor after four to six years.

c. Maize (*Zea mays*)

On heavy soils, maize is better applied with rotten farmyard manure or well-fermented liquid manure. Lighter soils are also manured especially during the dry season. An application of well-humified compost

after drilling the maize will give better growth, with the soil warming up more quickly. The compost also encourages root development so that juvenile growth will be more rapid. An additional application of dung liquor will stimulate growth further.

Maize yields can increase at a remarkable extent when repeatedly applied with horn silica.

Box 4. Assessment of the Biodynamic Approach

The whole concept of biodynamics revolves on producing high quality food by bringing in together all the forces of the earth combining it with cosmic forces to bring life back to the soil. Others perceive this concept as weird and unscientific practices (sometimes it is believed as a cult) because of the reliance on or belief in the spirits, zodiac and lunar influences. However, some of the practices has scientific basis although not everything can be explained clearly.

Some of the BD practices have been practiced in other countries but not entirely the BD components. Indigenous farmers are doing BD farming though they are not aware of it. Sowing or planting with regards to the moon has long been practiced in many areas in the Philippines. Indigenous farmers are very rich with this kind of wisdom and it really helps them in their crop production.

The principles of biodynamics are within sustainable agriculture. The soil as a living entity. Soil is given much importance not only as a source of nutrition of the plant but also as a source of strength so plants can ward off pest and diseases. Soil productivity is enhanced through the nutrient cycling by composting, green manuring and BD preparation. Unlike in conventional agriculture, which focuses on the production aspect, there is an excessive application of fertilizers and pesticides that leads to ecological imbalances.

Despite of the sustainability of biodynamics, acceptance is still low. The biggest problem on the implementation of its principles is the reductionist point of view of people, particularly scientists/researchers, agricultural technicians, farmers and the government. Government policies on agriculture are too much centered on the production aspect alone. Re-orientation on its program should be done towards the upliftment of the lives of the farmers. Farmers should be encouraged to be less dependent on external inputs and be self-reliant.

Another constraint for the adoption of BD in the Philippines is the problem in land tenure. Building-up of the soil, particularly the degraded ones would take quite some time. Therefore, tenants are usually hesitant to do so if they are not secured of the benefits in the long run.

The unavailability of the “ingredients” of BD preparations to the local farmers is another problem for the adoption. The ingredients are mostly imported and hence, it is very difficult for the farmers to obtain. However, they can discover other alternatives, which are locally available. Some groups are now into research of BD preparation alternatives.

Most of the BD techniques came from the Western countries. Hence, further studies need to be conducted in the Philippines for the application of BD preparations, so that the varying effects under different areas could be verified.

XI. Biodynamic Breeding: Literature excerpts

A. Breeding Diversity Biodynamically in Mainleus Germany by Martin Bossert and Peter Roatsie

From: Vellve, Renee. 1992. Saving the Seed. Genetic diversity and European agriculture. Earthscan Publications Limited. GRAIN. Pg. 102-103.

“In the breeding work, carried out with farmers and horticulturalists in the region, they emphasise yield security, genetic variability, food quality, storage, taste and wholesomeness, and improved resistance. To do this, they have been collecting and conserving a broad range of genetic diversity in the form of old folk varieties from all over the region. They are currently maintaining several hundred varieties of more than one hundred species. As these crops were developed locally by farmers before chemicals were around, they are being tested as regional varieties for ecological agricultural production. They are also being conserved and improved for the future.”

One important goal of their work is to revitalize seeds that have grown ‘tired’ through static and careless reproduction. For example, fundamental research on selecting rye through the so-called “ear-bed” method of Martin Schmidt has allowed them to strengthen the vigor and fertility of other cereals and vegetables too. The ear-bed method involved sowing seeds in a row in the order they grow on the head of grain where the most mature are on the top and the youngest on the bottom. When you grow out the seeds respecting this order, the plants in the middle of the row will grow the tallest. Not only do yields increase, but these plants are also stronger and more resistant to stress than those at the edge of the row.

B. Rice F₁ Hybrids: the Breeding Goal or a Costly Solution?

*From: CSIRO PUBLISHING.
www.publish.csiro.au/journals/ajar
Australian Journal of Agricultural Research,
2003, 54:1005-1011.*

Whether to develop inbred cultivars or F₁ hybrids is a dilemma faced by many rice (*Oryza sativa* L.) breeders. This could be partially answered if one could select superior recombinant inbred lines with an equal yielding ability and good quality traits from commercial F₁ hybrids. Thus, it was attempted in this study to select superior inbred lines from 2 commercial F₁ hybrids after application of honeycomb selection and panicle-to-row selection. The 2 F₂ populations were advanced to F₆ generation by both methods and, finally, 5 F₅:6 lines with high yield potential and good grain quality were selected from each population and selection method and were tested in a randomised complete block design for 2 years in Kalochori, Thessaloniki, Greece. In each case the respective F₁ hybrid and the cultivar Strymonas were used as checks. Fourteen of the 20 lines selected by honeycomb selection and panicle-to-row selection from both populations exhibited a yielding ability that was not significantly different from the yield of the F₁ hybrids in both years. Three of them, however, in 1 of the 2 years, had a significantly higher grain yield than the corresponding F₁ hybrid. In addition, 6 of the above lines exhibited significantly higher values for more than 1 of the 4 quality traits (total milling yield, grain vitreosity, grain length, and grain length/width ratio) and they were not inferior for the remaining ones. It was concluded that application of combined selection for yield and quality could lead to the isolation of recombinant inbred lines with equal yielding ability and quality equal to or higher than the F₁ hybrids. This, together with the higher cost associated with hybrid technology, indicates that the long-term goal of a rice-breeding program

should be the production of superior inbred lines, unless hybrid production cost is low and quality is not critical for the particular market.

C. Some principles and methods being used in bio-dynamic breeding:

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<http://www.biogene.org/e/themen/saatgut/cherfas.htm>

From the aim of farming is apart from sustainable culture generation the generation of food. In the process of use and transformation of the ingested food the human being internalizes in intimate fashion images of the external world and generates energy for his emotional and spiritual development.

The methods used for growing and breeding influence to what extent the nutrient can really feed the human being in the sense outlined in the previous paragraph.

The aim of bio-dynamic breeding is to breed plants or to breed plants in a manner that enables them to fulfill this task.

That means for the aims of breeding:

1. Open pollinating cultivars

Specimens and cultivars are to be fertile and consistent to enable them to adapt to their environment and to develop in it. The cultivated plant is a companion to the human being and should in future be available to anyone as cultural good.

Therefore it is not desirable to churn out new cultivars as fast as possible but rather to maintain cultivars, that have proved to be

good, through breeding methods that enable them to further improve and develop.

2. Harmony of growth and shape

The growth of plants is based on mechanism that shows themselves in the well ordered phases of the plants development and the metamorphosis of leaves. This is the precondition to develop the ability to mature and the plants nutritional value that depends on it.

3. Ability to mature

With “mature” we mean the state of a fruit for consumption in which it

- gets its typical shape
- the ability to grow recedes so that the fruit can develop sweetness and aroma
- the plant has reached a certain durability and can be stored
- physiologically the major part of the lower molecular compounds have transformed themselves into higher molecular compounds (e.g. mono- into disaccharides, low molecular amino acids into higher molecular proteins...)

Only a fruit that is mature in this sense (the mature apple when picked comes off nearly by itself and falls into our hands) has developed taste and aroma, is wholesome and can in the above sense serve as food.

Many of the common types show a deficiency in their ability to mature. The cereal ears have lost their colour, it is more a dying on the still green stem than a maturing. Hybrid carrots show an insufficient transformation of monosaccharide into disaccharides. The metamorphoses of leaves show that the contraction of the last leaves is incomplete or doesn't occur at all (in modern wheat cultivars the uppermost leaf is most of the time the biggest, not the smallest leaf).

Maybe one could consider the insufficient development of aroma an insufficient ability to mature.

4. Taste

The taste shows the whole picture, the composition of the fruit. It is also the expression of the well-balancedness and the harmony of its growth. This becomes clear, on the one hand through the fact that irregularities of growth (impeded growth, too dry, too wet, illness) correlate with a change of taste. On the other hand, breeding practice shows that a selection according to taste creates numerous changes in other areas like:

- augmentation of the total sugar content
- improvement of maturation
- increase of dry substance content
- decrease of nitrate content
- improvement of vitality after only one generation
- augmentation of secondary plant content (colouring, taste) that improve the creation of tolerance

5. Ability to resist

From a breeders point of view it is more sustainable to favour the general field-resistance, tolerance, than the resistance against only one factor because.....

- a. for this the plant has to be considered and selected in its entirety which has a positive impact on its overall shape and its quality as a nutrient
- b. most resistances become obsolete pretty soon and offer therefore no long term perspective (e.g. lettuce)
- c. they are often taken from plants that are genetically so remote from the bred plant that the adding of resistance properties is increasingly performed with the help of bio-and gene technological methods

6. The question of yield

To what extents maximum yield and quality are compatible and at what point they exclude each other have to be assessed for the different cultures.

Wheat shows a negative correlation of yield and protein content. With tomatoes that are bred for taste a considerably lower yield seems acceptable because it is compensated for by higher prices.

Considered from the angle of the plant's growth dynamic the vegetative expansion in the early stage and the contraction at the mature stage are polarities comparable to the antagonism between nitrogen and calcium.

A too one-sided concentration on the formation of mass (emphasis on vegetative processes) is detrimental to the ability to mature. What is the limit as far as yield and quality are concerned? Can we nevertheless and may be in the very consideration of the mechanism of polarity in the development of the plant achieve an improvement as well?

7. The question of homogeneity

The law concerning the protection of cultivars (seed trade law) and the demands of the market require a high degree of homogeneity of crops. We know from phytomedicinal research and experience that the mixture of cultivars or even better of species of cereals show much better health than homogenous seeds.

Hybrids are in this respect a "trick". They are largely homogenous and offer a maximum of heterozygosity. What is the relation between the demand for homogeneity/uniformity and the need for resistance/stability? How does this affect the quality? The cultivation of vegetables requires homogenous crops even from cross-fertilizers. The example of cabbage and cauliflower shows that open pollinating cultivars can reach sufficient uniformity, as

far as size and time of harvesting are concerned, without losing genetic variety.

The deliberations show that biotechnological methods and the cultivation of hybrids (at least at their present state of development and application) are not fit to be used in bio-dynamic breeding because:

- The propagation is supposed to happen on the plant and generative at every stage
- The plant and the cultivar are supposed to be fertile and stable. Seeds have a cultural value.
- During the breeding process the plant is supposed to interact with the environment for which it is bred. The environment is an important factor in the breeding process.

In addition to that, biotechnological methods

- were either developed to save time(in-vitro selection, quick propagation, anther-cultures) Time is only important if one wishes to achieve a rapid change of cultivars and the cultivars are to be marketed commercially.
- or to overcome cross-fertilization barriers (embryo and ovarium cultures, mentorpollen that have been treated with radiation, protoplastfusion). These are mainly applied in the improvement of resistance the results of which cannot, as shown, be regarded as an sustainable way to improve the plant's health.

Methods being used in bio-dynamic farming

1. Positive and negative mass selection, individual selection with assessment of the progeny.

Cross-fertilizers and most varieties of vegetables are cross-fertilizers, show a sufficient variation of the crops that substantial improvements of the existing cultivars can be achieved.

2. Cross-breeding

Where the variety is not sufficient- and that applies especially to self-pollinating plants, cross-breeding can achieve an improved variety which forms the basis for selection.

3. Further possibilities to create variety

The following methods are already being used to a certain extent but require further research:

- Fruit or ear bed method: The different positions of seeds on the plant provide different qualities. Sown separately they create plants of different shape. Those could be the basis for a new selection
- Influence of constellations: the sowing during different planetary and moon constellations produces differently shaped plants too. To what extent these different constellations can be used to produce exact results requires further research.
- Bio-dynamic preparations improve the plant's ability to perceive its environment in a general sense. Could this be used specifically apart from the general effect for breeding purposes?
- In earlier traditions of spiritual farming rituals, singing and speech were used to work with plants. What artistic approaches, appropriate to us, can we develop?

All methods apart, it is *human beings* who breed. Their actions and attitudes have an influence on plants. In other words: to a large extent their relationship with the plants is the agent that does the breeding. Therefore the human being is not a factor that should be excluded as far as possible but the very relationship between human being and plant and the human being's knowledge of the plant's true essence bear possibilities for breeding.

D. How can we improve the seeds from a biodynamic perspective?

From: Biodynamic Farming and Gardening Association. 1999. Stella Natura: Inspirational and Practical Advice for Home Gardeners and Professional Growers in Working with Cosmic Rhythms. Biodynamic Farming and Gardening Association. Phoenixville, PA.

Using ripe biodynamic compost will make future plants ever more responsive and sensitive to biodynamic practices. Compost as well as the Horn Manure Preparation (500) will increase the vigor of the seeds Horn Silica (501) is especially important when growing seed crops, since it enhances the working of the formative forces in the plants. It also helps the ripening of the seeds, and aids the keeping quality. Using Moon-Saturn oppositions for planting or spraying times, especially when spraying the Horn Silica preparation, brings a balance between the forces of reproduction and those of nutrition. Working with the sidereal moon might also have good effects in plant breeding. Planting closer to the winter months will improve the reproductive strength of grains, while planting further away from the winter months will improve their nutritional value. This may also hold true for vegetables. Generally speaking, exposing plants in subsequent generations to polar opposite conditions, like growing on a valley floor and then at high altitude, in hot followed by cool climates, will open up the plants for new influences and will make them more malleable for breeding. The practice of burying seed for breeding in water-tight jars in the earth during the Holy Nights at mid-winter gives them extra vitality, and opens them up to the crystalline forces in the earth at that season.

These are some of the biodynamic practices used in seed growing and breeding. Not enough has been tried out and documented so far. There is a great need for people to

work in this field and to exchange their ideas, also internationally. A first beginning for this will be at the Agriculture Conference the Goetheanum in Switzerland in February, 1999. But we can work from our own farms and gardens on improving our understanding of seeds and contributing to ever greater use and supply of biodynamic seeds. There are several sources available for sale. More growers are needed to contribute to their supply.

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