

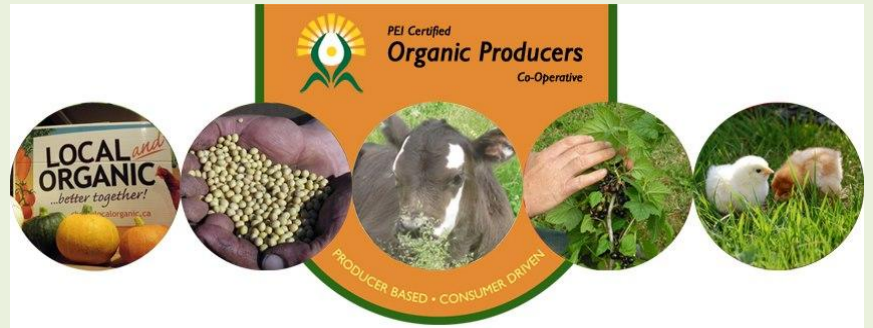
Organic Red Beet

Growers Manual

PEI ADAPT Council

Middelkamp Organic Produce

Hakkers Produce



Organic Red Beet Grower's Manual



Overview

This manual was developed in response to an inquiry from a processing company wanting to source local organic red beets for several new products. The company wanted the equivalent of 20 acres of Organic Red Beets for the 2013 growing season. Yield was projected at 15 metric ton per hectare. The harvested yield was 25 metric ton per hectare.

The following recommendations for Organic Red Beet Production on Prince Edward Island were developed from a literature review and actual field observations. The information is based on one production season and is only a guide. Further variety and production trials will be necessary to provide a more comprehensive document. Organic red beets for processing could be a valuable crop for organic producers on Prince Edward Island.

Pre-Plant

Before planting horticultural crops in an organic system it is important to minimize potential weed pressure. Mechanically this can be achieved with shallow cultivations to stimulate weed seed germination. The soil should be worked lightly to stimulate germination and then worked again one to two weeks later to kill the emerged weeds. This procedure can be done more than once depending on the weed pressure of specific fields.

Deep tillage in the spring is not recommended for beets. The seedbed should be fine without clumps and loose. Be careful not to overwork the soil and cause compaction.

Pre-plant tillage can be completed with harrows, roto-tillers or cultivators. Whichever implement is used it is important that the final pass leave a firm, level seedbed.

Crop rotation

A one in four crop rotation is the minimum required for red beets to prevent disease and pest build-up. For organic production, one year in six years is preferable. It is important to take into account the other family members in the rotation such as Swiss chard and spinach to reduce a build up of crop specific pests and disease. In a rotation with Brassicas or spinach, the beet cyst nematode may become a problem. Wireworm may be a concern if planting into old pasture or hay fields. Good rotational crops for beets include potatoes, grain, onions and legumes.

Fertility

All fertilizer applications should be based on a comprehensive soil sample. Beets need a total nutrient requirement per hectare of 250 kg of Nitrogen, 50 kg of Phosphorus, 270 kg of Potassium, and 4.5 kg of Boron. Manganese may also need to be added depending on soil samples. Calcium and Magnesium may be supplied through dolomitic or calcitic limestone.

Use lime to maintain a pH of 6.5 to 6.8 in all parts of the field. Beets are especially sensitive to low pH and should not be planted in soil with a pH below 6.0.

The primary challenge in organic systems is synchronizing nutrient release from organic sources, particularly nitrogen, with the crop requirements. In cool soils, microorganisms are less active, and nutrient release may be too slow to meet the crop needs.

Organic fertility sources include manure (solid or liquid), chicken manure pellets (4-1-2) or liquid fish fertilizer (3-3-0.1). Make sure these sources are permitted for organic production.

If applying manure, the preferred time for application is in the fall. This application is a good starting point to prepare your soil fertility for the following year. During the season chicken pellets can be used or a liquid fish fertilizer such as Organic gem. The chicken pellets are a slow release fertilizer providing minerals for up take over a longer period of time, whereas the liquid fertilizer will be available almost immediately.

A liquid fertilizer can also be used at planting. By applying the fertilizer to the seed it will help the seed establish quicker. A low rate of Organic Gem is recommended, if the rate is too high the nitrogen in the fertilizer may burn the germinating seed.

Varieties

Three varieties were planted: Red Cloud, Red Ace and Moneta. These varieties were chosen to produce the greatest sugar content and quality. Most beet seed are multi-germinating which means that each seed can produce more than one beet. Multi-germinating seed can result in uneven stands and sizing in the crop. For this reason a mono-germinating variety (Moneta) was also planted to evaluate whether there was any improvement in size and yield. The Moneta produced a more uniform size profile but yields were similar to the multi-germinating varieties. We concluded that for processing, mono-germinating varieties were not justified considering that the seed is more expensive to purchase.

A certified organic farmer is required to plant certified organic seed, if after contacting at least three suppliers, organic seed is not available, than the certifier may allow conventional untreated seed to be used.

Planting

Red beets can be seeded whenever the soil has warmed up in the spring. Ideally soil temperature should be around 15⁰C. On Prince Edward Island planting can be done from late May until the first week of July. Later planting will not produce the size profile required to meet processing requirements. Earlier planting will generate higher yields and an earlier harvest. An early harvest should mean a cleaner product going into storage.

Red beet seed requires a firm, moist seed-bed to germinate. For seed-bed preparation work the soil shallow, about 3 cm deep, to create a firm soil underneath. Irrigation may be required when planting during especially during dry periods. Red beets should be planted shallow, +/- 1.5 cm deep.

It is important that the seed is planted uniformly in every row to ensure even growth and sizing.

The amount of seed required per hectare depends on the harvest specifications. Processing Beets are planted on 600,000 seeds per hectare. Beets grown for fresh market should be planted at 500,000 seeds per hectare. The lower seed rate allows for a larger size profile for the beets.



Beet can be grown in a number of different planting systems. This depends primarily on the available equipment. Beets can be grown in rows, on beds or on potato hills.

Most beets are grown on beds with 4 to 7 rows between the tractor tires. The bed width can range from 1.5 – 1.8 meters.



It is very important in an organic production system to select a system that permits cultivation between the rows to reduce weed competition. A row spacing of 20 cm or wider will allow for cultivation.

A precision vegetable planter is required with the correct beet seed discs. The disc size used will depend on seed size and in-row spacing of the seed.

Weed control

Weed control during the first 4-6 weeks of growth is very important. Beyond that the beets should be able to compete with weeds without significant reduction in yield. High weed pressure will reduce marketable yield and may also create problems during harvest and subsequent storage. Once the red beets have established a good canopy of leaves they are more competitive against weeds. Prior to reaching canopy cover, the beets provide little competition for weeds.

Weed control starts before planting. Two or three pre-plant cultivations are required to reduce the population of germination weeds in the spring and lower the weed pressure later in the season. These cultivations should be shallow to avoid bringing new weed seeds to the surface or drying out the lower soil structure



Once planted, a pre-emerge burn down with a propane burner can be done. It is important that this is carried out before the tender beet seedlings emerge. A pre-emerge pass with a tine weeder can be risky because of the shallow planting depth.

Once the beet seedlings have emerged and you can see the rows, start in-row cultivation. The timing of in-row cultivation depends on the strength of the plant and the soil conditions. A crust on the soil surface can damage the small red beet plants when moved by a cultivator. When the plants are strong enough, a tine-weeder can be used to control germinating and small weeds. Timing is key in all the weed control practices. Don't wait for the weeds to grow! Cultivate or tine-weed as soon the plant size and soil conditions allow.

The last defence in weed control is hand weeding. This can be done with a hoe, or a weeding bed. A weeding bed is a tractor mounted machine that people lay on to hand pick weeds.

Diseases

Leaf Spot (*Cercospora beticola* Sacc.) causes one of the most widespread, destructive and economically significant beet diseases in the world. *Cercospora* leaf spot fungus feeds on the beet's sap. Early infection before the beets begins to bulk will have the greatest effect on yield and quality. An infection occurring later in the season will usually only effect sugar levels and juice purity but not yield. Less than 30 spots per leaf will not appreciably reduce yield or quality. The first symptoms of leaf spot are

the development of extremely small, whitish spots on the leaves. Under the correct environmental conditions the spots grow rapidly and become brownish and bright purple in colour. As the spots increase in number, the leaves turn yellow then brown and eventually die. The cause of leaf spot is free moisture on the leaves from relative humidity above 90%, day time temperatures between 25⁰C- 35⁰C and night temperature above 15⁰C. These conditions allow moisture to stay on the leaves for a prolonged period of time.

The remnants of diseased leaves is the primary source of future infections, but secondary sources are host plants such as lamb's quarters, redroot pigweed, curly dock and dandelion.

Control in organic production is very limited. A 4-5 year rotation is recommended. If possible remove infected leaves at harvest. Good weed control and increased spacing between plants will increase air flow and reduce standing water on plants during times of high humidity.

Common Scab or Potato Scab is another disease in red beets. Scab is a soil-borne organism that begins attacking the plant when the tuber or root starts forming. As the beet root grows the scab will enlarge. Scab can live on decomposing material and does not need a host crop such as red beets to survive, therefore a 4-5 year crop rotation is required. Scab can also be managed using irrigation. Irrigation keeps the soil moist when the roots begin to form.

Great care should be taken to avoid the application of organic fertilizers or other materials that make the soil highly alkaline especially lime and poultry manure. Soil with a lower pH balance will be less likely to result in scab but the danger is that soil may become too acidic to grow other crops.

Rhizoctonia is a soil born fungus disease in red beets. Rhizoctonia can result in 30-60% yield loss and even the loss of an entire field. Often times, Rhizoctonia is responsible for damage to seedlings as they germinate. Once infected, the plants become vulnerable to other diseases such as damping off.

Rhizoctonia symptoms are water soaked darkened tissue, starting below the soil and eventually spreading to the entire plant. The best way to manage this disease is to plant red beets under ideal conditions, with temperatures around 15⁰C and sufficient moisture in the soil. It is also very important not to plant too deep, less than 1.5 cm. Planting too deep will increase the likelihood of Rhizoctonia and Damping off because the seedlings take longer to germinate and emerge thus exposing them to the disease for longer periods. The plant growth will stall and eventually it will die.

Harvest

Harvest generally starts in September and depending on the area to harvest can last into October. Red beets can tolerate a light night frost. The harvest date also depends on the required size profile of the beets.

Red beets can be harvested with standard potato harvesting equipment or with a specialized carrot harvester. A carrot harvester is preferred for fresh market beets (beet sold with top). For processing beets, a potato harvester is recommended as it has a higher volume capacity. Beets can be harvested in one pass or windrowed first. This depends on the equipment available.



Just prior to harvest, the leaf foliage should be removed. A topper similar to an onion topper can be used. It is important for quality storage that as much foliage as possible is removed from the beets without cutting into the beets themselves. Beets can be transported off the field in live bottom trailers or in pallet boxes depending on the intended storage.

It is important during harvest that beets are as clean as possible leaving the field. Excess soil and weed or leaf material in the beets can result in significant loss in storage. The soil or leaf material restricts airflow through the pile causing the pile to heat.



Storage

Beets shall be stored at 6⁰C, with little ventilation. Beets harvested under good conditions can be stored until June with refrigeration. Without proper ventilation and moisture control, beets will shrink in storage

from moisture loss which can affect the quality of the beets.

Conclusion

Variable yields were seen between fields. One field was replanted because of a severe infection of Rhizoctonia. Weed control was good. Once the crop established it was able to compete with and eventually drown out the weeds. A four week period of drought from mid July to mid August caused some distress for the plants although they recover well with rainfall.

Harvest was completed later than planned in early in November. After a period of wet weather some dry, warm days allowed for the harvest of a crop with limited amounts of clay and weeds. There was some heating in a portion of piled beets whereas the beets stored in pallet boxes had more airflow which helped to cool the beets.

We concluded that organic beet production on Prince Edward Island is a viable crop.

Cost of Production

Cost/acre	Unit	Price	Total
Land rental (ac)	1	\$150	\$150.00
Operational Costs			
Field /seedbed preparation	3	\$35	\$105.00
Planting	1	\$50	\$50.00
Mechanical weed control	5	\$25	\$125.00
Harvest	1	\$250	\$250.00
Labour - Hand Weeding (hrs)	40	\$15	\$600.00
Seed	1	\$400	\$400.00
Fertilizer - Manure, chicken pellets	1	\$600	\$600.00
Fertilizer - Starter fertilizer, boron	1	\$500	\$500.00
Total cost per acre			\$2,780.00

This manual was funded with support from the PEI Adapt Council and the Canadian Agricultural Adaptation Program (CAAP).