

3.2 Seed Selection, Storage, and Cutting (L. Delanoy, C. Schaupmeyer, D. Ziprick, D. Kirkham)

3.2.1 Seed Selection and Purchase

No amount of cultural management will make up for a seed lot with poor vigour. It is important to select seed that is:

- Certified
- Free from seed-borne diseases
- From a grower with a good reputation
- Free from decay
- Firm (stored properly)
- Physiologically young (produced without major stresses)
- Small in size - 8 oz (225 g) or less
- Uniform in size

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These factors contribute to the production of a complete stand of uniform plants with the potential for high yields of top quality tubers.

Selecting seed that is classified by the Canadian Food Inspection Agency (CFIA) as Certified or better will ensure that the seed meets minimum standards for disease, trueness to variety, physical soundness and tuber size. See *Seed Potato Production Pyramid* in section 6.1 *Seed Potato Act and Regulations* for more details regarding seed classes. In Alberta, provincial legislation specifies that only certified seed potatoes are permitted for planting, unless formal permission is granted by the Potato Growers of Alberta. In Saskatchewan, the Bacterial Ring Rot Control Regulations, included under the Pest Control Act, indicates that a potato grower must plant seed that is certified as foundation or higher class. This also applies to market gardeners. In Manitoba, non-certified seed may be planted, however, much of the potato production is grown under contract for processing and the contract stipulates that the seed must be certified as Elite 4 or higher class.

Insist on receiving a copy of the post harvest test results before agreeing to purchase seed. Viral diseases do not produce visible symptoms on the outer surface of the tubers, so visual appearance is not necessarily a complete indication of quality seed. The incidence of viruses in a certified seed lot can be determined from the post harvest test results issued by CFIA accredited laboratories or CFIA reports of winter nursery tests. See section 6.4 *Post Harvest Testing* for more information.

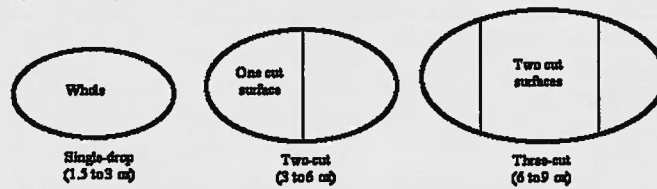
When purchasing seed, ensure that the seed grower has a good reputation. Also, check that the growing area has a history of producing quality seed. A visit to prospective seed suppliers both during the growing season and once the crop is in storage will help to assess the grower and the crop.

Determine the conditions under which the seed was produced and stored. The potato seed should not be stressed in the field. Seed should be stored at temperatures between 37 and 39°F (3 and 4°C) to ensure viability. Although potato seed may appear healthy, it may have poor germination and poor vigour if it was grown under stress, or if it was chilled or frozen in the field or in storage.

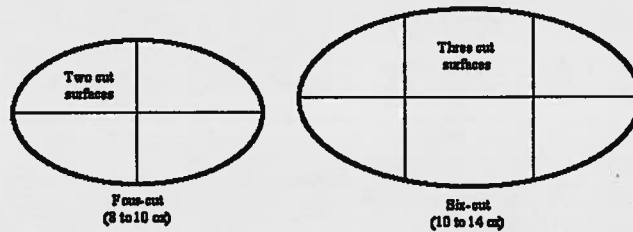
Assess the uniformity and size of the seed tubers. Performance of cut-seed pieces is affected by size of the uncut mother tubers (Figure 3.2-1). Smaller, uniformly sized mother tubers result in:

- Uniform, blocky cut-seed pieces
- A higher proportion of the most productive seed piece sizes (1.5-3 oz (43-85 g))
- Better planter performance, which contributes to high plant stands and correct spacing.

Figure 3.2-1 Seed-piece types cut from different sized mother tubers.



*Seed pieces cut from small tubers (above) are more productive on average than those cut from larger mother tubers (below)
 *Growers should avoid cutting seed from tubers greater than about 8 oz (225 g) like those below

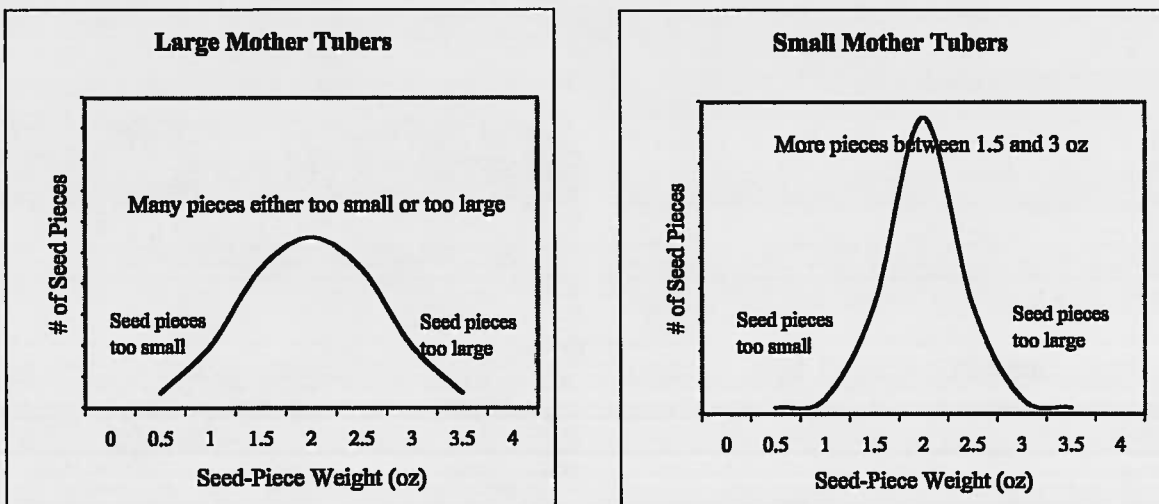


Oversize seed tubers result in many cut-seed pieces that are too large or too small (Figure 3.2-2). Small seed pieces (less than 1.5 oz or 45 g) produce weak, unproductive plants. Large seed pieces (greater than 3 oz or 90 g) are no more productive than ideal (1.5-3 oz (43-85 g)) seed pieces but cost more to plant. Variably sized and shaped seed pieces do not flow well and may not be picked up by planter picks or cups causing a reduction in plant stand.

Oversize seed tubers result in many cut-seed pieces that are too large or too small.

On average, seed pieces cut from large mother tubers (>8 oz (225g)) are not as productive as pieces of the same weight cut from smaller tubers. Seed pieces cut from larger tubers have fewer eyes and may result in blind seed pieces (no eyes), causing a reduced stand.

Figure 3.2-2 Distribution of seed piece sizes cut from large and small mother tubers (not to scale)



Negotiate terms of the seed purchase. When negotiating purchase of a seed lot, determine the method of delivery, date of delivery, desired tuber size distribution, tuber temperature and degree of sprout development.

Seed should be inspected upon delivery, and if the commercial grower has concerns about the grade, quality or physical condition, both the seed supplier and CFIA should be contacted within two days to request a re-inspection. If an inspection is requested, a CFIA inspector will carry it out within five working days of receipt of the request. The commercial grower should have unopened seed potato bags on hand or a bulk-movement certificate (in the case of bulk lots) so that the proper information can be obtained regarding the seed lot purchased. Seed tags or bulk-movement certificates are a grower's assurance that inspected seed potatoes have been purchased.

3.2.2 Whole Versus Cut Seed

There are several advantages to using whole over cut seed. Uniform lots of small, whole tubers ranging in size from 2 to 4 oz (60 to 110 g) can produce plants with:

- High vigour
- Increased stem counts
- Increased tuber set
- Uniform tubers that tend to be smaller because of the heavier set
- Less disease

Eliminating cutting reduces the risk of spreading tuber-borne diseases. Since there are no cut surfaces, seed decay is less likely; therefore, seed piece fungicides are not normally applied to whole seed. However, some growers apply fungicides for control of *Rhizoctonia* when black scurf is present on whole seed. If late blight is suspected on the seed tubers, use a seed treatment with an active ingredient effective in controlling seed-borne late blight.

Unfortunately only a small amount of whole seed is available in Western Canada. Many North American varieties do not produce large tuber sets, so it is not economical to produce whole seed tubers. Often whole seed tubers are obtained by grading out the 2 to 4 oz (60 to 110 g) tubers from the seed lot. These small whole tubers sell at a premium. The capital and operating costs of cutting must be weighed against the benefits of reduced handling, and higher cost of purchasing whole seed.

3.2.3 Sanitation, Handling and Storage of Seed Lots

Seed lots should be stored, cut and handled under sanitary conditions to prevent the spread of disease and reduce losses from disease organisms that cause rot. Sanitation consists of cleaning and disinfecting all equipment, storage, tools and pallet boxes that contact the seed potatoes. Since most disinfectants are inactivated by soil and plant debris, it is essential that this material be removed by thoroughly-cleaning equipment and storage with a pressure washer or steam cleaner before the disinfectant is applied. The seed storage and all equipment coming in contact with the seed lot should be disinfected with a quaternary ammonium compound such as Ag-Services Incorporated General Storage Disinfectant, Bardak 2210 Disinfectant Sanitizer, or DMR-23 Disinfectant. Surfaces must remain wet for at least 10 minutes for the disinfectant to destroy disease organisms.

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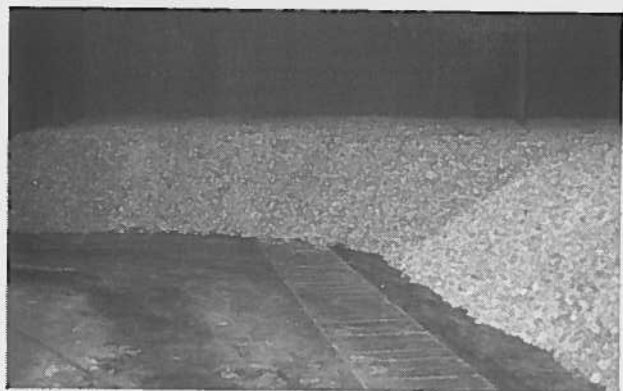
A commercial grower may be required to provide several different storage environments depending upon the time of seed delivery and the method of seed cutting used. Whole seed is typically delivered between February and April and should be stored at 37 to 39°F (3 to 4°C) and 90% R.H. until just before cutting. Growers can choose between two seed cutting methods: 1) standard seed cutting where seed is cut, treated and planted the same or next day or 2) pre-cutting, where the seed is cut, treated, stored for up to 3 weeks before planting.

The standard seed cutting method is the most common. Before cutting, seed should be warmed to 50-55°F (10-13°C) for 10 days, unless sprouts have already appeared. Warming helps break the dormancy maintained during cold storage and will accelerate emergence. If the tubers are beginning to sprout then dormancy is already broken. In this case, warm tubers to 45° F (7°C) to avoid shatter bruises caused by handling and cutting. Shatter bruises affect seed vigour and the bruises can become infected with *Fusarium* dry rot, causing poor emergence.

Bruises affect seed vigour.

The pre-cutting method helps spread out the work load at planting time, however, this practice should only be attempted if recommended temperature, airflow, and humidity can be maintained. Before cutting, seed should be warmed to 45-50°F (7-10°C) to avoid shatter bruises caused by handling and cutting. The depth of the cut-seed pile is limited by the ability of the ventilation system to maintain a proper temperature throughout the pile (Figure 3.2-3). Typically cut seed is piled no deeper than 3 to 8 feet (1 to 2.5 metres). After cutting, maintain the seed pile at 45-50°F (7-10°C), 90% R.H. for 5 days to allow the cut surfaces to suberize (heal). After suberization is complete, cool the cut seed pile to 41-46°F (5-8°C).

Figure 3.2-3 Pre-cut seed stored at a depth of less than 8 feet (2.5 m) (Courtesy of Gaia Consulting Limited)



Precautions should be taken during cutting, storage and at planting time to ensure that the cut seed pieces are not exposed to drying conditions and direct sun. Trucks, which are transporting cut seed to the field for planting, should be tarped to reduce exposure to dry air and sunlight.

3.2.4 Seed Cutting

Most European growers plant small, whole seed tubers. An increasing number of Canadian growers are planting whole seed (see section 3.2.2 *Whole versus Cut Seed*), but the most common practice is to cut whole seed tubers into smaller seed pieces.

The object of cutting is to produce uniform seed pieces with an average weight between 1.75 and 2.25 oz (50 and 65 g) (Figure 3.2-2). Growers should consult with their provincial potato specialist or processor field staff for seed size recommendations. Some varieties (Shepody and Yukon Gold) have poor eye distribution and larger seed pieces ranging from 2.25 to 2.50 oz (64 to 71 g) are recommended.

The majority of mother tubers in an uncut seed lot should be 8 oz (225 g) or less, with few tubers greater than 10 oz (225 to 300 g). Growers should maximize the number of seed pieces with single cuts, and minimize the number of tubers with two and three cut surfaces (Figure 3.2-1). This can only be accomplished if the mother seed lot does not contain many tubers over 8 oz. Variation in seed piece size results in variability of size, shape and yield of tubers from plant to plant.

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mother tubers in an
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Seed pieces weighing less than 1.5 oz (35g) are referred to as seed chips. The chip eliminator rollers on the seed cutter should remove the seed chips because they result in unproductive plants. Improper chip eliminator roller adjustment or overloading the cutter are the main causes of excessive numbers or chips in a cut seed lot.

To reduce seed piece infections, cutter knives must be kept sharp. Sharp blades result in smooth cut surfaces that suberize (heal) quickly. Dull blades cause ragged cut surfaces that are easily infected with decay organisms. Cutters should be disinfected at least once a day or between every seed lot. Pay special attention when disinfecting the rollers as they tend to hold pathogen-laden debris. If seed is handled or cut at a temperature of 45°F (7°C) or less, the incidence of shattering bruising may increase and cause seed decay.

Seed piece fungicide treatments should be applied to all seed lots immediately after cutting. Growers must assess field location and seed source histories to determine which fungicide seed treatment to apply. Seed treatments effective against late blight are recommended if the seed originated from an area where late blight was reported. Other seed-piece treatments that control *Rhizoctonia* sp. and silver scurf are recommended when seed or field location indicates a risk for disease inoculum.

3.2.5 Determining Cut-Seed Size

Producers should manage seed cutting so the average seed piece is 2 oz (60 g) and the majority of pieces are between 1.5 and 3 oz (35-85 g) (Figure 3.2-2). Specialty market needs may demand different seed sizes and growers should verify these needs with packer or processing field staff.

**The majority cut seed
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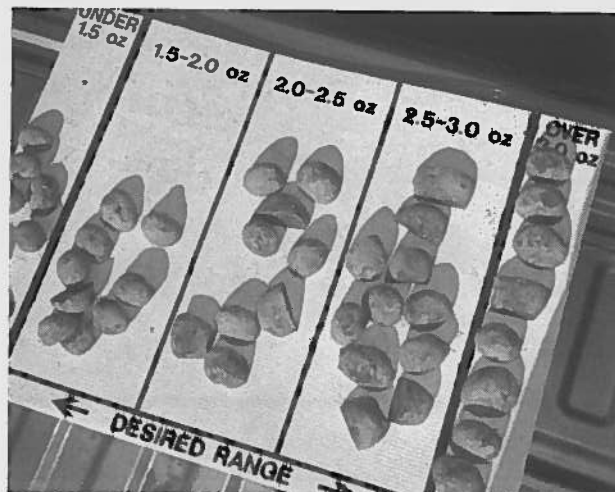
Cutter performance is determined by regularly calculating the average cut seed size and seed size distribution. At the very least, these calculations should be performed each time a new seed lot is cut. Mother tuber size, which varies with each seed lot, affects the performance of the cutter. During cutting, samples of seed pieces should be collected and individually weighed. The average size is calculated by dividing the weight by the number of seed pieces. For example, a 12.5 lb (5.4 kg) sample with 97 pieces has an average weight of just over 2 oz (60 g). The average seed size is not a good measurement of seed cutter adjustment. The average seed size may be ideal (2 oz (60 g)), but a majority of the cut seed sizes might occur outside the ideal seed size range of 1.5 to 3 oz (35-85 g). See the graph for Large Mother Tubers shown in Figure 3.2-2. Seed size distribution is the best measurement of the cutter performance. This is determined by individually weighing and arranging the seed pieces into size groups such as less than 1.5 oz (35 g), 1.5 to 3 oz (35-85 g), and greater than 3 oz (80 g) (Table 3.2-1 & Figure 3.2-4). Pieces can be further separated according to the number of cut surfaces such as whole seed, one cut surface, two cut surfaces and three cut surfaces. This grading and sorting is best accomplished by placing seed pieces on a board that has been marked similar to the example in Table 3.2-1. The size distribution data can be used to produce a bar graph. The resulting bar graph should resemble the line graph for Small Mother Tubers shown in Figure 3.2-2, where the greatest number of seed pieces occurs in the ideal size range.

Seed cutter adjustment is complicated and novice growers should seek advice from the dealer, processor or provincial potato agronomist.

Table 3.2-1 Cutter adjustment chart.

Seed type	Seed piece weight		
	< 1.5 oz (35 g)	1.5 to 3 oz (35-80 g)	>3 oz (80 g)
Whole			
1 cut surface			
2 cut surfaces			
3 cut surfaces			

Figure 3.2-4 Cut seed sorted by weight



3.2.6 Planting Rates

Average seed weight, between-row spacing and in-row spacing affect the amount of seed required per acre or hectare (Table 3.2-2). Between-row spacing varies from 34 to 38" (86-97 cm), with 36" (91 cm) being the most common in Alberta and Saskatchewan and 38" (97 cm) the most common in Manitoba. In-row spacing varies between production areas, variety and market. See section 3.3.2 *In-row Seed Spacing* to determine the appropriate in-row spacing.

Table 3.2-2 Weight of seed required for 2 oz (60 g) seed pieces planted at different in-row spacing in rows spaced 36" (91 cm) and 38" (97 cm) apart (rounded to nearest 100).

		In-row Spacing						
		6" (15 cm)	8" (20 cm)	10" (25 cm)	12" (31 cm)	14" (36 cm)	16" (41 cm)	18" (46 cm)
Seed @ 36" (91 cm) row spacing	lbs/ac	3600	2700	2400	1800	1600	1400	1200
	kg/ha	4035	3026	2690	2018	1793	1569	1345
Seed @ 38" (97 cm) row spacing	lbs/ac	3400	2600	2300	1700	1500	1300	1150
	kg/ha	3811	2914	2578	1905	1681	1457	1289