FROM PLANTLET TO FRENCH FRY PROCESSING PLANT

Potatoes arriving at a french fry processing plant are the end product of several integrated production systems, all aimed at producing high quality potato tubers. Once the appropriate cultivar has been chosen, disease-free seed stock is produced and multiplied. The seed tubers are then planted on a commercial farm to produce the crop destined for processing. At each level of production, the tubers must be stored under the proper conditions to ensure the processing plant receives high-quality potatoes.

Potato Cultivars

Commercial french fries in North America are produced from predominantly three potato cultivars, Russet Burbank, Shepody and Innovator. All have high specific gravity (a measure of dry matter), low sugar content and are oblong to long in shape. These characteristics result in a high yield of long, light-coloured french fries. Russet Burbank is the mainstay of the industry and the cultivar most in demand by quick service restaurants. Shepody and Innovator are used because they mature earlier in the growing season than Russet Burbank and give a high recovery of finished product.

A good potato crop begins with high quality seed tubers

Potatoes are propagated vegetatively. A small whole tuber or piece of a larger tuber is planted in the field to produce the crop. Consequently, there is a risk of disease carry-over from one growing season to the next and precautions must be taken to reduce the possible infection of the crop in the field during the growing season. In Canada, to assure a high level of uniform quality seed, tubers are grown under a national seed certification system.

Seed production begins by establishing plantlets in test tubes thus providing a disease-free environment for their growth. The process starts with sprouts removed from a tuber and placed on nutrient medium. It can take up to 16 weeks for these sprouts to grow into a plantlet. Once plantlets are determined to be free of viral, viroid, fungal and bacterial pathogens, they are multiplied by nodal cutting. The plantlets are divided into pieces and grown on a nutrient medium. After 6 months of repeated cutting in culture, a single plantlet can yield 18,125 new plantlets. These plantlets are then used as a disease free source for subsequent seed production.

The process starts by using these plantlets to produce Nuclear Stock seed tubers (minitubers) in an enclosed environment, a greenhouse or screen house. The minitubers are then planted the following season to produce the first field generation of seed potatoes. The potatoes are multiplied in the field for several years on specialized seed farms to produce enough seed tubers to plant the commercial acreage needed by a processing plant. With each successive field generation, the risk of disease and the level of disease may increase. To minimize the risk, growers rogue all unhealthy plants, follow a pro-active pest management program and topkill the vines 80-90 days after planting. Seed potatoes are also inspected in the field and storage by Canadian Food Inspection Agency officers to meet certification standards aimed at minimizing diseases present in a seed crop. The presence of disease in seed tubers reduces yield and impacts processing value of the crop. Potato Leafroll Virus, for example, is carefully monitored because it may result in stem end necrosis in the tubers of some cultivars rendering them unusable for processing, notably Russet Burbank.

Each autumn seed tubers are held in dedicated environmentally controlled storage facilities until spring planting. To maintain varietal purity, each seed lot and cultivar is stored separately. Seed tubers are stored at high relative humidity and a constant 4°C to maintain quality and minimize sprout growth before planting. No chemical sprout inhibitors are used in the seed storage.

Producing the commercial crop

When producing a crop of potatoes destined for the fry plant, certified seed tubers are planted in the spring. It is recommended that growers follow a three-year crop rotation that includes cereals. At the time of planting, fertilizer is incorporated into the soil. The crop is managed to produce potatoes with desirable processing characteristics: large size, high dry matter content and lack of internal disorders. Rigorous pest and disease management programs are followed so a healthy crop is harvested and stored. Growers scout each field regularly for signs of insect pests and diseases, and apply the appropriate control measure when necessary. Crop growth is monitored closely to ensure vigorous growth, proper plant nutrition and give an indication of crop maturity status.

Above-ground green leaves and stems are often removed with chemicals (called topkilling) approximately three weeks prior to harvest. Topkilling prevents the tubers from getting too large, sets the tuber skin, and allows for timing of harvest to avoid inclement weather (frost) during harvest or supply the fry plant at a desired time. In New Brunswick, tubers are harvested approximately 110-120 days after planting. A small portion of the potato crop is processed into french fries directly from the field. The remaining harvested tubers are held in storage.

Storing the crop

Storing processing potatoes is a specialized art. Freshly harvested tubers are first cured at 13°C for several weeks to heal wounds and set the skin. The temperature is then lowered to 8° - 10°C for long term storage. Humidity, ventilation and temperature are carefully controlled to maintain tuber quality. Storage temperatures are kept constant and above 7°C to prevent the accumulation of sugars which result in dark processed products. Sprout inhibitors are applied either as a spray in the field or through the storage ventilation system in the late fall to stop the tubers from sprouting. Developing sprouts dehydrate tubers and reduce quality. Tubers must be stored up to 10 months to ensure a constant supply of raw product for the plant.

Timeline: plantlet to processing plant

New Brunswick tuber yields

Production system	Time (years)	Seed planted	Tuber yield
Seed Crop			
In vitro plantlets	0.5	Plantlets: 45/m^2	Minitubers: 6.3 kg/m^2
Nuclear Stock	0.5	Minitubers: 900 kg/ha	Seed tubers: 13.5 t/ha
Seed tuber increase	3-4	Seed tubers: 2.5t/ha	Seed yield: 27.0 t/ha
Commercial crop	1	Seed tubers:1.75 t /ha	Processing tubers: 29.8 t/ha
Total	5 - 6	Raw product: 10 tonnes	Processed yield : 5.3 tonnes

The potatoes that originated from a tiny piece of sprout in the laboratory over five years ago are now ready to be processed into french fries.

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