



# CULTIVAR TRIALS ON FIELD-GROWN TOMATOES

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One of the most challenging vegetables for home and market gardens in Alaska is the tomato. Most commercial tomatoes are grown in greenhouses, but Fairbanksans have been experimenting with outdoor field culture since at least 1915 (Georgeson 1916). Attempts to identify plants hardy enough to mature fruit in our short, cold growing season usually result in few or no ripe fruit and plenty of green tomatoes. In the 1960s, Dr. Arvo Kallio introduced the

first early-ripening salad tomato that would consistently mature fruit outdoors (Kallio 1970). Early Tanana remains a popular cultivar although the fruit is small and susceptible to cracking in wet weather. Breeding efforts by Fairbanks horticulturist John Holm introduced Sub-Arctic 25 followed by a series of mostly open-pollinated cultivars including Polar Baby and Polar Beauty (Campbell 1995). The Early Tanana and Sub-Arctic 25 tomatoes remain standards for outdoor home and market gardens in the Interior. Even on the warmest sites, use of soil-warming polyethylene mulches is recommended for all outdoor tomato cultivars (Matheke & Holloway 2000).

Since the 1970s, many new cultivars of early-ripening tomatoes have been made available through commercial seed catalogs. The purpose of this research was to evaluate new commercial cultivars and compare them against one of our standards in an attempt to expand the choices of outdoor-grown tomatoes for interior Alaska.

## Methods

Tomato cultivars Glacier, Kootenai, Northern Delight, Oregon 11 (2000-2002), Oregon Spring (2004 only), Prairie Fire, Stupice, and Moskvich were chosen based on their advertised earliness of ripening. Oregon Spring was used to replace Oregon 11 in 2004 when seed for the latter was no longer available. With its long local history, Sub-Arctic 25 was used as a standard.

Tomato plants were germinated in the greenhouse in PRO-MIX 'PGX' medium seven weeks before transplanting into the field. Seedlings were transplanted about 10 days after seeding into PRO-MIX 'BX' growing medium in 1801H Cell Paks (18 cells, 31/8" x 31/16" x 31/8", per 10" x 20" flat). One week after transplanting, weekly fertilization was begun using Sunshine Technigro soluble



**Table 1. Tomato total seasonal yields for 2001, 2002, and 2004.**

2001			2002			2004		
	Yield			Yield			Yield	
	Mean Weight/ Plant			Mean Weight/ Plant			Mean Weight/ Plant	
Cultivar	(lb)		Cultivar	(lb)		Cultivar	(lb)	
Sub-Arctic 25	4.4	a*	Prairie Fire	1.6	a†	Glacier	8.6	a*
Northern Delight	4.2	a	Sub-Arctic 25	1.6	a	Prairie Fire	7.2	ab
Prairie Fire	4.0	a	Northern Delight	1.5	a	Northern Delight	6.0	bc
Oregon 11	3.8	ab	Stupice	1.0	ab	Sub-Arctic 25	6.0	bc
Glacier	3.2	ab	Glacier	1.0	ab	Stupice	5.9	bc
Kootenai	3.1	ab	Kootenai	0.9	ab	Oregon Spring	5.4	c
Stupice	2.8	ab	Oregon 11	0.8	ab	Kootenai	5.1	c
Moskvich	2.0	b	Moskvich	0.1	b	Moskvich	0.5	d

\* values with the same letter are not significantly different (P<0.05, Waller-Duncan K-ratio t-test)

† values with the same letter are not significantly different (P<0.05, Tukey's Studentized Range (HSD))

**Table 2. Yield and mean fruit weight averaged over three years.**

	Yield			Mean	
	Mean Weight/ Plant			Fruit Weight	
Cultivar	(lb)		Cultivar	(oz)	
Prairie Fire	4.3	a*	Moskvich	5.8	a†
Glacier	4.2	a	Prairie Fire	4.3	a
Sub-Arctic 25	4.0	ab	Kootenai	2.6	b
Northern Delight	3.9	ab	Stupice	2.1	b
Stupice	3.2	ab	Glacier	1.9	b
Kootenai	3.1	b	Northern Delight	1.6	b
Moskvich	0.9	c	Sub-Arctic 25	1.4	b

Note: Oregon 11 and Oregon Spring were excluded from this analysis because they were tested for fewer than three years.

\* values with the same letter are not significantly different (P<0.05, Waller-Duncan K-ratio t-test)

† values with the same letter are not significantly different (P<0.05, Tukey's Studentized Range (HSD))



—Photo by Wikipedia en:User:Fir0002

16-17-17 Plus fertilizer at 250 ppm nitrogen. Plants were hardened outdoors in a cold frame for five days and then transplanted into the field during the first week of June.

Field plots of Fairbanks silt loam soil were fertilized with 10-20-20 sulfate of potash at a rate of 4 lbs/100 ft<sup>2</sup> and rototilled prior to transplanting. Plants were transplanted through IRT-100 wavelength selective plastic mulch for soil

warming and weed control. Plants were irrigated as necessary using Roberts Ro-Drip trickle irrigation tape placed beneath the mulch. Spacing was 5 feet between rows and 2.5 feet between plants in each row. The eight cultivars were planted following a randomized complete block design with four blocks and one plant per treatment in 2000-2002 and two plants per treatment in 2004.

**Table 3. Summary weather records for the trial years.**

Season	2000	2001	2002	2004
Average temperature (°F):				
May	44	45	50.4	52
June	59	56.5	57.6	66
July	59	60.5	61.3	65
Aug	51.5	57	53.9	62
Sept	41	48.5	40.8	38
Maximum temperature (°F)	83	95	82	90
Growing season:				
Last Frost	May 15	May 13	May 12	May 8
First Frost	Sept 16	Sept 24	Sept 2	Sept 4
Frost free days	124	134	112	119
Thaw degree days*	2943	3439	2980	3751
Rainfall (inches)	8.55	5.80	9.35	5.06

\*Cumulative average daily temperature minus 32°F base temperature

Fruits were harvested, counted, and weighed three times per week, weather permitting, when red color first appeared. Tomatoes were harvested before they were fully ripe in order to minimize unauthorized harvesting by visitors. Data were analyzed using a factorial Analysis of Variance (ANOVA) for cultivars and years. Mean separations were performed using the Waller-Duncan K-Ratio t-test for even cell sizes and Tukey's Studentized Range (HSD) for uneven cell sizes.

## Results

Due to a cold, rainy growing season no tomatoes ripened in 2000 and no data were collected. In 2001 and 2002 no cultivar had a significantly higher yield than Sub-Arctic 25 (Tables 1 & 2). The yield of all cultivars increased due to warmer seasonal temperatures in 2004 (Tables 1 & 3). Glacier, whose production was around the median in 2001 and 2002, had the highest yield in 2004 and was the only cultivar with a significantly higher yield than Sub-Arctic 25. Glacier appears to have been able to respond to the warmer seasonal temperatures in 2004 with a greater increase in production than the other cultivars tested. Prairie Fire and Northern Delight were among the top three yielding cultivars in all three years tested (Table 1). Moskvich had significantly lower yields than Sub-Arctic 25 in all three years (Tables 1 & 2). In 2004, Oregon Spring and Kootenai had lower yields than the two most productive cultivars, Glacier and Prairie Fire, while Moskvich had significantly lower yields than all other cultivars (Table 1).



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Moskvich and Prairie Fire had significantly larger fruit than all other cultivars when results for all three years were analyzed (Table 2) and in 2001 and 2004 (Table 4). Yields were quite low in 2002 (Table 1) and there were too few fruit harvested to make many statistical distinctions in average fruit weight among cultivars (Table 4). Prairie Fire produced consistently high yields (Figures 1-3, Tables 1 & 2). In 2004, the only year it was grown, Oregon Spring had significantly larger fruit than all other cultivars except Moskvich (Table 4) and its production was not significantly lower than any cultivars except Glacier and Prairie Fire (Table 1). However, it appears to be a little later maturing than all other cultivars except Moskvich (Figure 3) and it may not perform well when the weather is not as favorable as it was during the 2004 growing season.

**Table 4. Mean Fruit Weight for 2001, 2002, and 2004.**

2001			2002			2004		
	Mean Fruit Weight			Mean Fruit Weight			Mean Fruit Weight	
Cultivar	(oz)		Cultivar	(oz)		Cultivar	(oz)	
Moskvich	8.0	a*	Prairie Fire	5.3	a†	Oregon Spring	5.0	a*
Prairie Fire	4.0	b	Kootenai	3.7	ab	Moskvich	4.3	ab
Kootenai	2.2	c	Moskvich	3.5	ab	Prairie Fire	3.6	b
Stupice	1.7	c	Glacier	2.9	ab	Kootenai	2.2	c
Northern Delight	1.6	c	Stupice	2.6	ab	Stupice	2.0	c
Oregon 11	1.3	c	Sub-Arctic 25	1.9	ab	Glacier	1.8	c
Sub-Arctic 25	1.1	c	Northern Delight	1.7	b	Northern Delight	1.5	c
Glacier	1.1	c	Oregon 11	1.2	b	Sub-Arctic 25	1.2	c

\* values with the same letter are not significantly different (P<0.05, Waller-Duncan K-ratio t-test)

† values with the same letter are not significantly different (P<0.05, Tukey's Studentized Range (HSD))

**Table 5. Annual Yield and Mean Fruit Weight averaged over all cultivars**

Yield			Yield			Mean Fruit Weight		
Year	Number of Fruit/Plant		Year	Mean Weight/Plant (lb)		Year	(oz)	
2004	44.3	a*	2004	5.6	a	2002	2.9	a
2001	33.4	b	2001	3.4	b	2004	2.7	a
2002	7.7	c	2002	1.1	c	2001	2.6	a

\* values with the same letter are not significantly different (P<0.05, Waller-Duncan K-ratio t-test)

In the two years we tested Oregon 11 (2001, 2002), it was among the earliest varieties harvested (Figures 1 & 2). In 2001 it had a significantly higher yield than all other varieties from July 20-July 30 (Figure 1). However, it is prone to severe growth cracking and suppliers have ceased carrying it.

Moskvich was the latest-maturing tomato in the trials, producing only a few fruit in 2002 (one tomato for every four plants) and 2004 (2.5 tomatoes per plant). In 2001, when the growing season lasted until September 26, its production improved to an average of nearly 5 fruit (918 grams or 2.0 lbs) per plant (Figure 1). Moskvich is the only cultivar tested that cannot be recommended for Fairbanks gardens.

As one would expect, seasonal weather patterns (Table 4) resulted in significant differences in yield (Table 5). The yield was highest in 2004, which was an excellent season

for growth of warm-season crops, and lowest in 2002, which was a relatively rainy and cool summer. The 2001 season was not particularly warm, but the long frost-free period of 134 days was associated with substantially higher yields (Figure 1). There was no difference in mean fruit size among years, which is what one might expect since fruit size is controlled more by the genetic traits of the cultivars than by seasonal differences in weather.

## Recommendations:

Many of the new cultivars tested in these trials would make an excellent supplement to the commonly grown ultra-early outdoor tomato, Sub-Arctic 25, for interior Alaska gardeners. Prairie Fire was among the highest-yielding cultivars in the three years we collected data. Prairie Fire, with 1.5-inch to 2-inch diameter fruit, outweighed our standard

Figure 1. Cumulative Yield of Tomato Cultivars tested in 2001

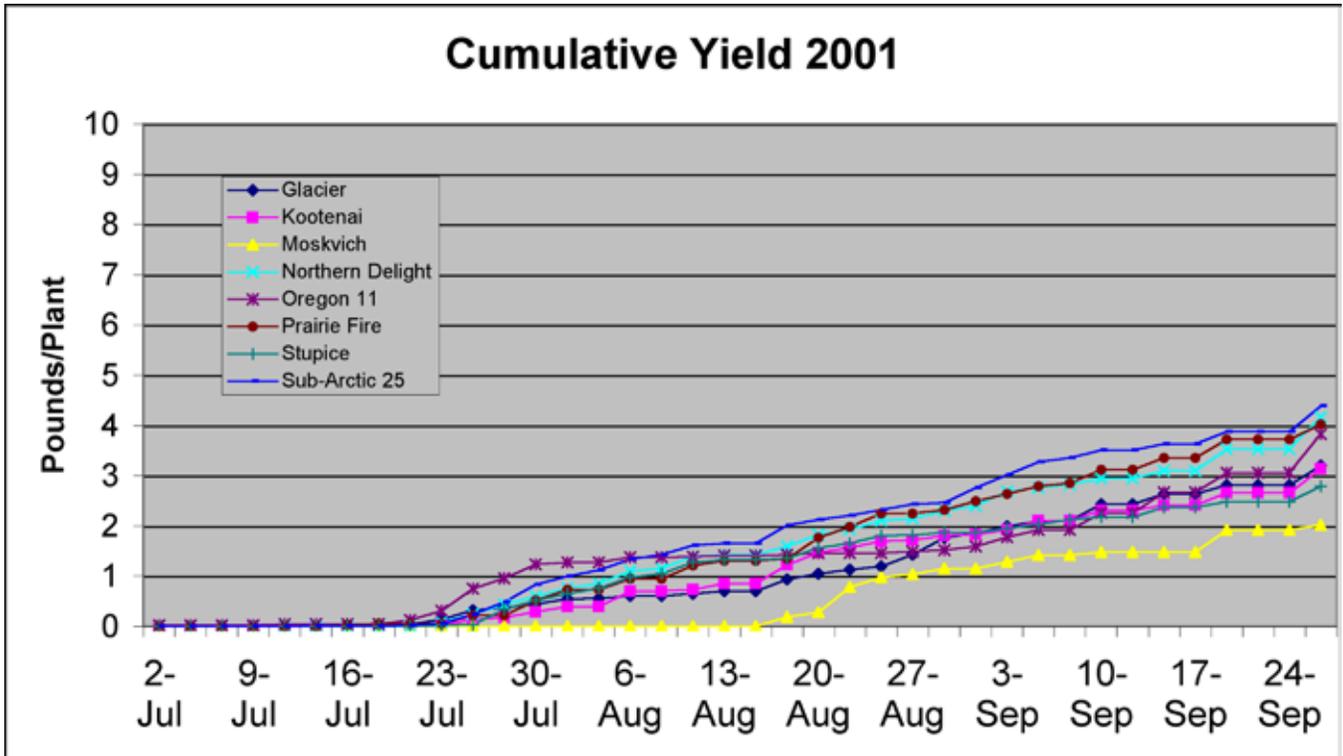


Figure 2. Cumulative Yield of Tomato Cultivars tested in 2002

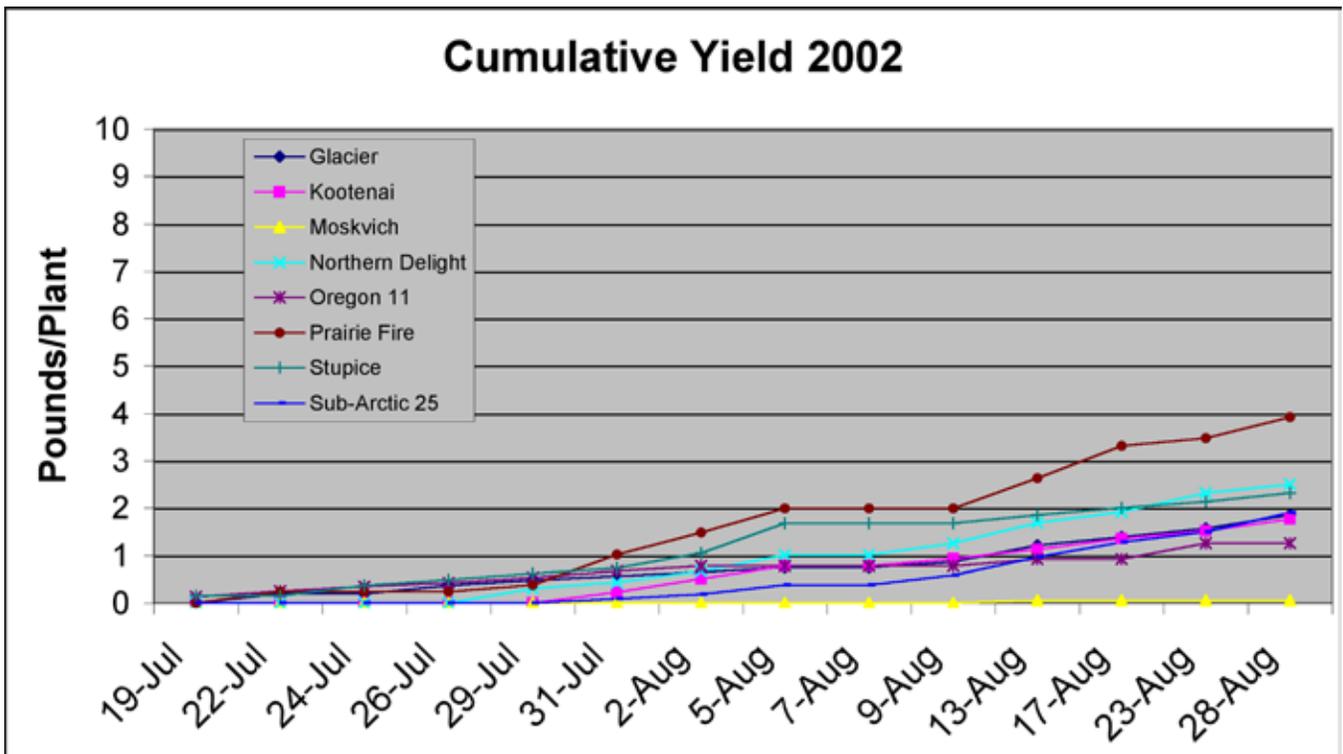
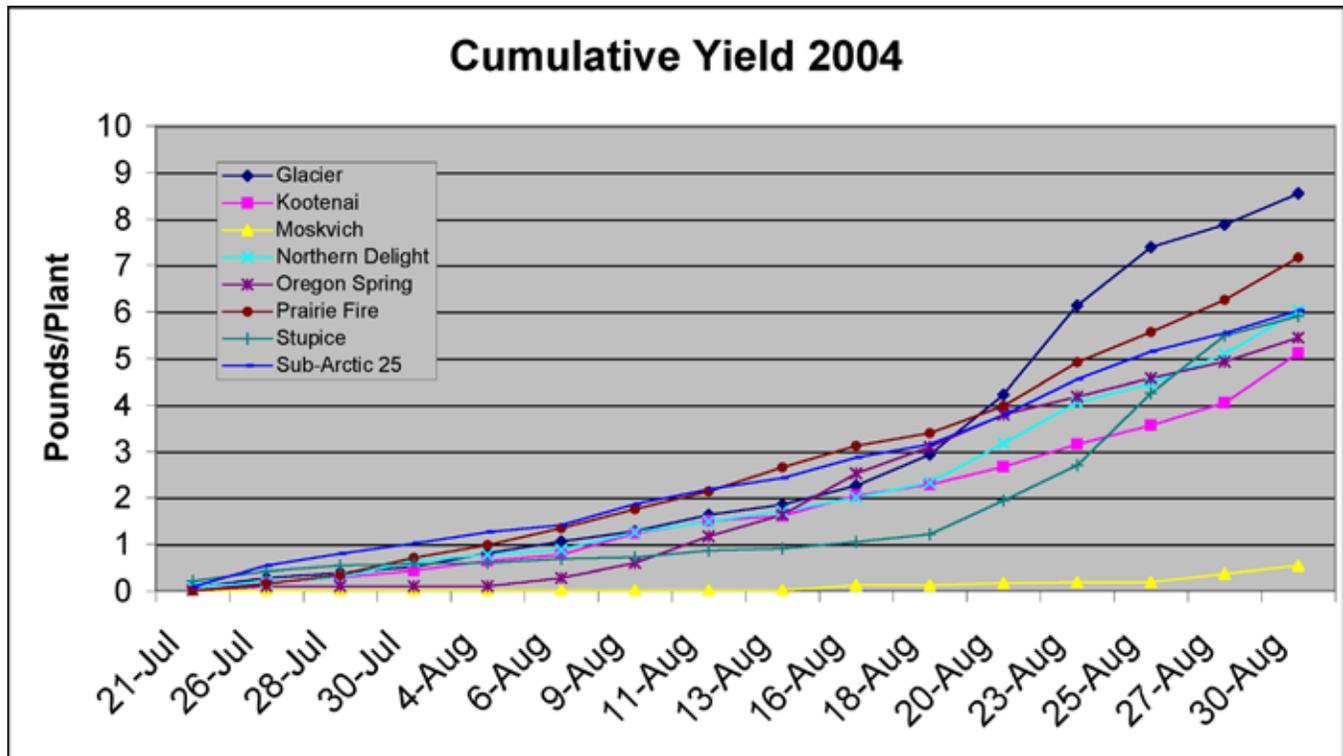


Figure 3. Cumulative Yield of Tomato Cultivars tested in 2004



outdoor tomato, Sub-Arctic 25, by about three times. It is the largest-fruited tomato we have been able to grow that also produces high yields. A number of years ago, we tried growing another larger-fruited tomato, Siberia, but its yields were significantly lower than Sub-Arctic 25.

Glacier, Kootenai, Northern Delight, and Stupice are also worth trying. While not significantly larger or higher-yielding than Sub-Arctic 25, they produced attractive fruit on sturdy, attractive plants and represent alternative cultivars that gardeners may find preferable to Sub-Arctic 25. Despite the good results in most years, all cultivars may fail in cold summers even with the use of soil-warming IRT mulch.

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## Appendix I. Catalog or University Variety Descriptions

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Descriptions are listed under their source

### Oregon State University

<http://eesc.orst.edu/agcomwebfile/garden/vegetable/pnwtomatoes.html>

#### OREGON 11

Released in 1982, it is a very early tomato with first ripe fruit by July 15. Possibly 75 percent of the fruit are seedless. They tend to crack, but Oregon 11 is valuable to gardeners in very cool areas. Fruit are 2 inches in diameter maximum.

#### OREGON SPRING

Released in 1984. Large fruits ripen in early August. Oregon Spring fruit are not very firm but are useful for the local market. Some fruit can have large blossom scars (cat-faces) and grow up to 3.5 inches in diameter.

### Territorial Seed Co., P.O. Box 158, Cottage Grove, OR 97424-0061

<http://www.territorial-seed.com/stores/1/index.cfm>

#### GLACIER

(OP) 55 days. You can count on Glacier to usher in the tomato season. This very early tomato variety produces attractive orangey-red 2.5 inch tomatoes. Perfect for salads or fresh eating. Surprisingly sweet for an ultra-early type. Expect a determinate habit plant that is about 2.5 feet tall, 3.5 feet across, and quite open.

#### STUPICE

(OP) 60-65 days. This cold-tolerant tomato ripens sweet, red, slightly oval, 2-inch fruit that make an excellent choice for first-of-the-summer salads, lunch boxes, and juicing. Stupice consistently gets high marks for taste throughout the summer. Pumps out fruit over the entire season. Bred in the former Czechoslovakia. Indeterminate potato leaf variety.

#### NORTHERN DELIGHT

(OP) 65 days. Northern Delight was bred to perform in the short season of the Far North. Short, 24-inch determinate plants bear loads of 1.5-inch wide by 3-inch long red fruit. If you like a mellow sweet flavor with just a hint of acidity, give Northern Delight a try! Plant with your early crop to kick off the season.

#### OREGON SPRING

(OP) 75-80 days. This now-famous determinate slicing variety was developed at Oregon State University. Their research shows that Oregon Spring will produce incredibly

early yields of 4-inch oval tomatoes when planted outside a month before your last frost date and given no protection except on frosty nights.

### Peters Seed & Research

P. O. Box 1472, Myrtle Creek, Oregon 97457

<http://www.pioneer-net.com/psr/page16.html>

#### PRAIRIE FIRE

(50-55 days) A large super-early tomato. Very beautiful, smooth, globe-shaped fruit with small stem and blossom end scars. Generally weigh from 3-6 ozs each. Transplant before the first flowers open and manure or fertilize heavily. Your reward will be good-flavored fruit of the largest sizes and in abundance. Determinate.

### Tomato Growers Supply Company

P.O. Box 2237, Fort Myers, FL 33902

<http://www.tomatogrowers.com/index.html>

#### PRAIRIE FIRE

Intensely red, 3- to 5-oz. tomatoes on very short, bushy plants light up the garden, earning this variety its name. Its full flavor is tangy yet nicely balanced with sweetness and is superior to many cold-weather tomatoes. Very productive plants give a large crop early in the season. This variety is a result of a cross between Sub-Arctic and a beefsteak tomato. Determinate. 55 days.

### Johnny's Selected Seeds

955 Benton Avenue, Winslow, Maine 04901

<http://www.johnnyseeds.com/>

#### MOSKVICH

Received under the name Moskvich from a correspondent in Eastern Siberia in 1991, we were impressed with its hardiness, size, and taste. It ripens just behind Kotlas and ahead of all similar-size varieties. The deep red tomatoes have a smooth texture and rich taste that belie its earliness. Fruits average in the 4-6 oz. range, and are smooth and globe-shaped with a small stem scar. Indeterminate.

### Denali Seed Co.

<http://www.denaliseed.com/catalog.html>

Wholesale only. If seed is not available locally the website above has a list of mail order suppliers.

#### SUB-ARCTIC 25

A DENALI EXCLUSIVE. A first early variety, Sub-Arctic 25 introduced by plant breeder John Holm of Fairbanks, Alaska, is very cold tolerant, setting heavy yields of high quality, solid, meaty, 2- to 4-ounce, bright red, flavorful, smooth globe-shaped fruits when the night temperatures are only in the 40s. The plants are compact

and produce their first blossoms very early. This compact variety is excellent for a container garden. Seeds must be started indoors 8 to 10 weeks before the last frost.

### Plants of the Southwest

3095 Agua Fria St., Santa Fe, NM 87507

<http://www.plantsofthesouthwest.com>

#### KOOTENAI

Great Russian introduction, superior taste. Medium-sized. Crack resistant, tolerates poor soil. Good yields. (75 days from transplants)



—Photo by Wikipedia User:FoeNyx

### Fox Hollow Seed Co.

204 Arch Street, Kittanning, PA 16201-1501

<http://www.foxhollowseed.com/>

#### KOOTENAI

64 days. Compact indeterminate. Three-inch tomatoes are borne on a bush plant. This variety performs well in patio pots and is one of the earliest, cold-tolerant and productive plants we've yet found. Moderately acidic, with a more zesty flavor than you'd find in most "earliest" tomatoes.



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