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# Bridger and Cascade Winter Rapeseed Varieties

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Bridger and Cascade are two new varieties of rapeseed (*Brassica napus* L.) released for commercial production in 1986. The two varieties possess unique quality and agronomic characteristics needed to ensure that rapeseed will become a viable crop in this country. These varieties are the result of extensive research in the production and genetic improvement of winter rapeseed conducted at the University of Idaho since 1976 (Fig. 1). Bridger and Cascade are cross-pollinated populations (synthetics) derived from four inbred parental lines. Both varieties are protected from unauthorized seed increase by U.S. Plant Variety Protection (PVP).

## Variety Descriptions

Bridger (PVP 8500171) is an industrial rapeseed variety that produces mature seed containing from 45 to 50 percent oil (Table 1). Over 50 percent of the fatty acids in the oil extracted from Bridger is the 22 carbon fatty acid, erucic acid. More than 10 million pounds of high erucic acid rapeseed oil are used annually in the U.S., either as a carefully regulated stabilizer of food products or as industrial oils. Most of this industrial rapeseed oil is imported from Canada and northern Europe. Domestic production of high erucic acid rapeseed oil would allow U.S. growers to capture existing markets and would encourage increased use of erucic acid in new products such as the manufacture of improved nylons.

Glucosinolates are toxic compounds that occur in many plants in the mustard family. These compounds can cause health problems when they are eaten by animals. Older industrial varieties of rapeseed such as Dwarf Essex produce meals that can contain over 100 micromoles of glucosinolates. These high levels of glucosinolates are so toxic that the meal can't be used as an animal feed. The meal that remains after the oil has been extracted from the seed of Bridger has less than 30 micromoles of glucosinolate per gram. The high protein meal obtained from processing the seed of Bridger is identical to the Canola meal currently imported into the Pacific Northwest from Canada as an animal feed supplement.

**Fig. 1. This foundation seed field of Cascade was grown in northern Idaho in the spring 1986.**

Cascade (PVP 8500172) is the first U.S. developed edible rapeseed variety that meets the erucic acid requirements (less than 2% erucic acid in the oil) of the U.S. Food and Drug Administration (Table 1). Low Erucic Acid Rapeseed oils (LEAR) have been shown to be excellent oils in human diets because they combine low levels of saturated fats (less than 6%), high levels of mono-unsaturated fats (62%) and a desirable level of alpha-linolenic acid (10%). Alpha-linolenic acid is one of the essential fatty acids that must be supplied in diets since humans cannot synthesize these compounds. Low erucic acid rapeseed oils were first approved in the U.S. in January 1985. In the fall

**Table 1. Fatty acid composition, glucosinolate concentration and oil content of certified seed of Cascade and Bridger winter rapeseed varieties.**

| Variety | Fatty acid composition of oil[1] | | | | | | | Glucosinolate content | Oil content |
|---|---|---|---|---|---|---|---|---|---|
| | Palmitic (16:0) | Stearic (18:0) | Oleic (18:1) | Linoleic (18:2) | Linolenic (18:3) | Eicosenoic (20:1) | Erucic (22:1) | | |
| | % | | | | | | | micromoles/g | % |
| Cascade | 4.5 | 1.6 | 61.6 | 19.4 | 10.7 | 1.4 | 0.3 | 16.0 | 44.1 |
| Bridger | 2.3 | 0.5 | 16.2 | 11.0 | 5.0 | 8.2 | 57.0 | 26.6 | 46.2 |

[1] Fatty acid ratios (16:0, 18:0, etc.) = Fatty acid carbon chain length:number of double bond.

of 1986, Proctor and Gamble used LEAR oil in their "new" Puritan Oil to capitalize on an increasingly health-conscious American market. Most of the LEAR oil used in this and a growing number of other retail products is imported from Canada.

The meal of Cascade has less than 20 micromoles of glucosinolates per gram (Table 1). The combination of low levels of erucic acid and glucosinolates allows Cascade to meet the stringent requirements imposed on "Canola" quality varieties by the Canola Council of Canada.

Bridger and Cascade were compared to the check variety, Dwarf Essex, in the U.S. national winter rapeseed variety trials conducted in 1984-1985 and 1985-1986. These trials included sites in the Pacific Northwest (PNW) and in the Southeast (SE) regions of the U.S. Bridger and Cascade flowered and matured earlier than Dwarf Essex at all locations (Fig. 2). At the most southern location (Tifton, GA), both new varieties flowered more than 30 days earlier than Dwarf Essex. At the cooler locations in the PNW, flowering differed by only 6 or 7 days. Bridger and Cascade matured 5 to 7 days earlier than Dwarf Essex in most trials. In the SE, earlier-maturing varieties facilitate establishment of a warm season annual as part of a double crop rotation. In the PNW, earlier-maturing varieties such as Bridger and Cascade would allow completion of rapeseed harvest before winter wheat harvest begins (Fig. 3).

Bridger and Cascade produce plants that are approximately 5 inches shorter than Dwarf Essex. Shorter rapeseed plants improve the harvest efficiency and help reduce lodging. The characteristics of these two varieties will also improve aeration in the crop canopy, and this could reduce losses to Sclerotinia white mold.

## Agronomic Performance — PNW

Bridger, Cascade and Dwarf Essex had similar levels of winter survival when averaged over the three locations in the PNW where differential winterkill occurred (Table 2). Only at Moscow in 1986 did Bridger and Cascade have a lower percentage of seedlings survive than Dwarf Essex. During 1985 at Moscow, the three varieties were exposed to prolonged snow cover followed by severe cold. Under these conditions both Bridger and Cascade had higher levels of winter survival than Dwarf Essex. Both Bridger and Cascade appear to have sufficient winter hardiness to grow well in most areas of the PNW.

The three varieties were compared for yield in only six tests in the PNW (Table 3). In these tests, Bridger and Cascade yields averaged only 85 and 70 percent, respectively, of Dwarf Essex. In small experimental plots, Bridger and Cascade suffered more seed losses to shatter and bird damage while harvest was delayed waiting for the later varieties such as Dwarf Essex to mature. At Moscow in 1986, birds caused an estimated 50 percent yield loss to earlier maturing varieties. Damage was minimal to later-maturing varieties such as Dwarf Essex. These losses increase variation between plots and make accurate yield comparisons difficult. With proper management and timely harvest, yields of Bridger should be slightly lower or comparable to those of Dwarf Essex. Even under optimum management practices, however, yields of Cascade and all Canola-quality varieties that have been currently evaluated will be 20 percent lower than yield of Dwarf Essex. The improved quality factors of Bridger and Cascade may command sufficient price premium to offset any reductions in seed yield. Growers also need to realize that edible rapeseed cultivars such as Cascade are used in markets that industrial varieties such as Dwarf Essex cannot exploit.

The oil content of Bridger, Cascade and Dwarf Essex averaged over 40 percent (Table 3). Both Bridger and Dwarf Essex had slightly higher oil content than Cascade, which can be expected when an edible (low erucic acid) variety is compared with an industrial (high erucic acid) variety. The oil content of all three varieties has been significantly higher (44 to 48 percent) in commercial production where more uniformly mature seed is harvested.

Fatty acid composition of Cascade met FDA requirements for edible LEAR oil at three of the four test sites (Table 3). At Prosser in 1986, Cascade had an average of 2.1 percent erucic acid in the oil. This exceeds FDA standards, but such values often occur in experimental plots containing both industrial and edible varieties because cross-pollination occurs despite the use of self-pollination sacks. At both trials in Moscow, the levels of erucic acid in Bridger and Dwarf Essex were similar. At Prosser in 1986 and at Kalispell in 1985, Bridger had higher levels of erucic acid. Under most conditions of the PNW, Bridger should produce levels of erucic acid equal to or higher than those produced by Dwarf Essex.

**Fig. 2. The determinant growth habit of Bridger (shown) and Cascade reduces the flowering period of both varieties. Natural insect predators like the ladybug shown help reduce harmful insect pests in winter rapeseed.**

**Fig. 3. Uniform maturity of Cascade (shown) and Bridger will allow an earlier and more rapid harvest of winter rapeseed crops.**

In all trials, both Bridger and Cascade had levels of glucosinolates in the seed meal less than 30 micromoles per gram (Table 3). The meal residue remaining after oil extraction of both varieties would consistently meet the requirements necessary to use this product as Canola meal. Dwarf Essex's seed meal averaged well over 30 micromoles per gram of glucosinolates which limits its use as an animal feed supplement.

## Agronomic Performance — SE

Bridger and Cascade were compared to Dwarf Essex at four locations in the SE where differential winterkill occurred (Table 2). When averaged over all four locations, Dwarf Essex had only 58 percent survival compared to over 85 percent survival for both Bridger and Cascade. The increased survival of the two varieties developed in Idaho was most dramatic in 1986 at Griffin, GA, when all the Dwarf Essex seedlings died as the result of an unusually severe winter, while Bridger and Cascade survived to produce a good seed crop. The differential winter survival observed in this region is probably caused by factors other than cold tolerance since Dwarf Essex survives very severe conditions in the PNW with little damage.

Bridger and Cascade have consistently produced higher yields in the SE than Dwarf Essex (Table 4). Dwarf Essex has produced average yields of only 850 pounds per acre compared to 1,100 and 1,470 pounds per acre for Cascade and Bridger, respectively. The later flowering and maturity of Dwarf Essex in the SE apparently causes severe yield reduction. In the SE as in the PNW, Cascade has a lower yield potential than Bridger. Similar yield responses have been observed with all Canola quality varieties tested in the SE.

Oil contents in the SE were lower than those observed in the PNW (Tables 3 and 4). The seed grown at Clinton, NC, in 1986 was probably not fully mature when harvested and consequently had fairly low oil concentrations. Seed grown commercially in the SE may not reach the oil levels obtained in the PNW, but most lots of both edible and industrial seed should exceed 40 percent.

At five of eight test sites, the erucic acid level of Cascade met the requirements of the FDA (Table 4). The increased level seen at three of the sites probably reflects cross pollination that occurred with industrial varieties in the trial. At four of six locations where direct comparisons are possible, Bridger produced higher levels of erucic acid than Dwarf Essex. These differences were slight at most locations and probably reflect the late maturity of Dwarf Essex.

Glucosinolate contents of Bridger and Cascade were consistently below 30 micromoles per gram at the seven locations in the SE where this trait was measured (Table 4). Glucosinolate content of Dwarf Essex exceeded 100 micromoles per gram at several locations. These data emphasize the importance in the SE of using varieties that have low levels of glucosinolates.

## Potential Markets for Bridger and Cascade

Both the edible and industrial uses of high erucic acid rapeseed oil (HEAR) are very limited. Growers producing Bridger or any industrial rapeseed variety must have a marketing contract or produce that crop for an assured market. The current needs for HEAR oil in the U.S. could be completely satisfied by only 10,000 acres of production. Export markets of HEAR seed and oil are highly competitive and quite small compared with edi-

**Table 2. Percent winter survival of Bridger, Cascade and Dwarf Essex winter rapeseed varieties in three tests in the Pacific Northwest and four tests in the Southeast in 1984-1985 and 1985-1986.**

| | Pacific Northwest (PNW) | | | | Southeastern U.S. (SE) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Moscow, ID | | Prosser, WA | | Miss. St., MS | Griffin, GA | Florence, SC | Orange, VA | |
| Variety | 1985 | 1986 | 1985 | Avg | 1985 | 1986 | 1986 | 1986 | Avg |
| | % winter survival | | | | | | | | |
| Bridger | 40 | 74 | 79 | 64 | 100 | 63 | 98 | 80 | 85 |
| Cascade | 48 | 70 | 76 | 65 | 100 | 78 | 71 | 93 | 86 |
| Dwarf Essex | 25 | 90 | 81 | 65 | 77 | 0 | 96 | 58 | 58 |
| LSD (0.05) | 24 | 14 | 21 | — | — | — | 17 | | |

**Table 3. Seed yield and quality of Bridger, Cascade and Dwarf Essex winter rapeseed varieties in six tests in the Pacific Northwest in 1985 and 1986.**

| | Moscow, ID | | Prosser, WA | | Ritzville, WA | Kalispell, MT | | |
|---|---|---|---|---|---|---|---|---|
| Variety | 1985 | 1986 | 1985 | 1986 | 1985 | 1985 | Avg | (% Dwarf Essex) |
| **Seed yield** | lb/acre | | | | | | | |
| Bridger | 2,260 | 5,730 | 3,070 | 4,180 | 1,750 | 2,740 | 3,290 | (85%) |
| Cascade | 1,780 | 5,580 | 1,660 | 3,490 | 1,870 | 1,960 | 2,720 | (70%) |
| Dwarf Essex | 2,340 | 7,860 | 2,100 | 5,480 | 2,470 | 3,110 | 3,890 | |
| LSD (p = 0.05) | 830 | 1440 | 1175 | 460 | 840 | 660 | | |
| **Oil content** | % oil | | | | | | | |
| Bridger | 43.6 | 41.0 | 43.1 | 42.0 | 39.6 | — | 41.9 | (100%) |
| Cascade | 42.2 | 40.8 | 39.5 | 40.1 | 38.2 | — | 40.2 | (96%) |
| Dwarf Essex | 42.3 | 40.8 | 41.6 | 42.9 | 41.1 | — | 41.7 | |
| **Erucic acid** | % erucic acid in oil | | | | | | | |
| Bridger | 46.9 | 49.2 | — | 50.4 | — | 59.5 | 51.5 | |
| Cascade | 0.0 | 0.0 | — | 2.1 | — | 0.0 | 0.5 | |
| Dwarf Essex | 45.8 | 50.3 | — | 46.7 | — | 40.4 | 45.8 | |
| **Glucosinolates** | micromoles of glucosinolate/g of defatted meal | | | | | | | |
| Bridger | 19.8 | 21.2 | 16.9 | 11.6 | — | 21.9 | 18.3 | |
| Cascade | 18.9 | 13.4 | 13.5 | 5.4 | — | 13.3 | 12.9 | |
| Dwarf Essex | 39.2 | 105.6 | — | 15.0 | — | 37.5 | 49.3 | |

**Table 4. Seed yield and quality of Bridger, Cascade and Dwarf Essex winter rapeseed varieties in eight tests in the southeastern U.S. in 1985 and 1986.**

| | Miss. St., MS | | Griffin, GA | | Tifton, GA | Florence, SC | Clinton, NC | Orange, VA | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1985 | 1986 | 1985 | 1986 | 1986 | 1986 | 1986 | 1986 | Avg | (% Dwarf Essex) |
| **Seed yield** | | | | | | lb/acre | | | | |
| Bridger | 2,150 | 1,270 | 1,730 | 1,270 | 1,305 | 1,140 | 1,940 | 950 | 1,470 | (173%) |
| Cascade | 1,985 | 700 | 980 | 1,370 | 1,170 | 890 | 1,120 | 560 | 1,100 | (129%) |
| Dwarf Essex | 1,635 | 750 | — | WK | 300 | 780 | 1,100 | 520 | 850 | |
| LSD (P = 0.05) | — | 720 | 400 | ns | 360 | 350 | 610 | 250 | | |
| **Oil content** | | | | | | % oil | | | | |
| Bridger | 42.8 | 43.7 | 41.2 | 40.1 | — | 39.6 | 31.1 | 38.2 | 39.5 | |
| Cascade | 40.7 | 41.9 | 38.3 | 37.2 | — | 38.6 | 26.7 | 35.7 | 37.0 | |
| Dwarf Essex | 43.0 | 41.1 | — | WK | — | 36.5 | 26.8 | 35.9 | 36.7 | |
| Erucic acid | | | | | | % erucic acid in oil | | | | |
| Bridger | 59.0 | 48.8 | 53.8 | 53.5 | 50.2 | 47.2 | 48.6 | 55.0 | 52.0 | |
| Cascade | 0.9 | 6.7 | 0.0 | 2.4 | 1.7 | 0.4 | 3.6 | 1.3 | 2.1 | |
| Dwarf Essex | 51.3 | 45.3 | — | WK | 47.7 | 48.4 | 22.7 | 55.5 | 45.2 | |
| **Glucosinolates** | | | | | | micromoles of glucosinolate/g of defatted meal | | | | |
| Bridger | — | 12.9 | 28.2 | 14.2 | 14.8 | — | 18.7 | 10.5 | 16.6 | |
| Cascade | — | 23.4 | 14.7 | 14.2 | 21.8 | — | 26.6 | 9.7 | 18.1 | |
| Dwarf Essex | — | 112.3 | — | WK | 78.9 | 81.6 | 41.1 | 109.0 | 84.6 | |

ble vegetable oil markets. Increased production of HEAR will require the development of new products such as improved nylons. These markets will probably grow at a relatively slow rate.

Cascade produces an oil that must compete in the domestic market with a broad range of edible vegetable oils including imported Canola oil. The increasing awareness in the U.S. of the health advantages of low erucic acid rapeseed oils will probably result in an increasing demand for this product. The lack of a PNW oil extraction and processing facility limits this region's ability to enter into this market. Production of Canola-quality varieties has great potential in the SE where existing oil extraction and processing facilities can be used. Cascade has shown excellent adaptation to this production area.

The export of Canola-quality rapeseed to Japan as whole seed may offer the greatest potential to the PNW. U.S. grown rapeseed must enter this market in direct competition with high-quality spring Canola from Canada. To be competitive in this market, U.S.-origin rapeseed must meet or exceed all of the quality components required of the Canadian Canola crop. Cascade offers PNW growers the ability to produce a premium grade crop. Increased production in this region is dependent upon Japanese demand for this commodity.

Growers must ensure that any rapeseed crop grown meets the specific quality components required for either the Food and Drug Administration or industrial oil purchasers. The first step in meeting these requirements is the production of varieties with proven and consistent quality components. Both Bridger and Cascade were selected to offer growers the potential of producing premium grade products.

## Seed Availability

Production of Foundation seed of Bridger (PVP 8500171) and Cascade (PVP 8500172) in the U.S. is the exclusive right of the North Idaho Foundation Seed Association (NIFSA). NIFSA approved dealers have agreed to make certified seed broadly available throughout the U.S. Seed production and the sale of seed outside the U.S. has been limited by contractual agreements. To obtain a list of NIFSA approved dealers, contact:

Executive Secretary NIFSA
P.O. Box 467
Lewiston, ID 83501
Phone: 208-743-8551

## Additional Information

Growers or processors desiring additional information are encouraged to purchase the following publications from Cooperative Extension Service county offices in Idaho or from Agricultural Communications Center, College of Agriculture, University of Idaho, Moscow, ID 83843.

EXP 634: Winter Rape Production Practices in Northern Idaho ($1.00)

CIS 782: Cabbage Seed Pod Weevil Control in Winter Rapeseed (35¢)

CIS 785: Idaho Fertilizer Guide — Winter Rapeseed (25¢)


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