ACS-C29 Summer Turnip Rape

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ACS-C29 summer turnip rape (*Brassica rapa* L.) is a canola quality, three-parent population-synthetic (Syn_1) cultivar adapted to the short-season growing areas of western Canada. On average, it yielded 13% more than the WCC/RRC checks over two years of testing and has high seed oil content.

ACS-C29 summer turnip rape (*Brassica rapa* L.), a canola quality population-synthetic (Syn_1), was developed at Agriculture & Agri-Food Canada, Beaverlodge Research Farm. It was tested in the short-season growing zones of the Western Canada Canola/Rapeseed Recommending Committee (WCC/RRC) co-operative trials under the experimental designation ACS-C29 in 2007 - 2008. ACS-C29 was recommended for registration in 2009 after two years of testing. ACS-C29 was issued registration no. 6621 on 15 July 2009 by the Registrar, Variety Registration, Seed Section, Canadian Food Inspection Agency, Government of Canada, Ottawa, Ontario.

Breeding Methods and Pedigree

ACS-C29 is a three-parent population-synthetic. The Syn_0 is composed of equal proportions of the populations TR1, TR3 and TR4. TR1 was derived from a composite of two populations, CompD and CompE. CompD was derived from crosses between Tobin and Echo while CompE from Tobin and Torch (Downey and Klassen, 1974). F_2 seed from both populations was bulked and sown in isolation and 3247 single plants threshed individually and subsequently screened for yellow seed coat colour prior to seeding, overall agronomic performance, glucosinolate content, and seed oil and meal protein content. This work was initiated by Dr. D.S. Hutcheson, formerly of AAFC-SRC and carried out for five cycles of (recurrent selection). At the end of each cycle, reserve seed was bulked and used to sow the next cycle of selection. Selections were largely based on agronomic performance and seed coat colour with less effort put on glucosinolate content and other quality parameters such as seed oil and erucic acid content. After five cycles of recurrent selection, an equal reserve seed bulk of 55 progeny were composited and sown in isolation and 2000 single plants threshed individually and screened for low glucosinolate content (TesTape method); 475 low glucosinolate progeny were field tested the following year. On the basis of good agronomics and quality, 50 progeny were selected, reserve seed bulked to form a composite for white rust screening (Race 7a). The population (7326 plants) was then screened for resistance to white rust; 1049 were selected, brush pollinated, seed equally bulked from each plant and subsequently screened for low erucic acid. In total, 297 half seeds were selected, intercrossed and bulked. The bulk was then re-analyzed to ensure that it was indeed low erucic and the same bulk was re screened for resistance to white rust Race 7a. This was done because of the high frequency of resistant plants found in the initial white rust screening. Another screen of 1200 plants for resistance to white rust resulted in 668 selections. An equal bulk of these was subsequently grown in isolation and approximately 300 plants harvested individually. Two hundred and ninety-seven progeny were assessed in a replicated nursery and selections made on the basis of good agronomics and quality. Twenty-three progenies were selected and reserve seed from each bulked and used to sow a composite crossing block. Approximately 927 single plants were harvested individually, TesTaped for low glucosinolate content and half-seeded to isolate low erucic acid plants. In total, 378 half-seeds were selected, intercrossed and subsequently bulked to form the breeder seed of TR1.

TR3 was derived from a cross between a population selected predominantly for high seed oil content and cv. Reward. Following two cycles of random mating, 2010 single plants were harvested and screened for low glucosinolate content; subsequently, 475 single plants were selected on the basis of low glucosinolate content and yellow seed. Seed of the selected progenies was sown in a replicated (3X) field nursery. Thirty superior progenies were selected on the basis of high oil and protein contents, low erucic acid and glucosinolate contents, and vigour. Breeder seed of TR3 was produced by bulking equal quantities of reserve seed from each of the 30 selected progenies.

TR4 summer turnip rape (*Brassica rapa* L.) is a breeding population with a total (aliphatic and indole) glucosinolate content of 4.2 μmoles g^{-1} oil free meal (Hutcheson, et al. 2000). It was derived from selections among segregating progeny of a cross between the low aliphatic glucosinolate breeding population BC86-18, and the low indole glucosinolate breeding population DLY.

Performance

On average, ACS-C29 yielded 13% more than the mean of AC Parkland and AC Sunbeam over two years of testing (Table 1). Two sites, one at Beaverlodge and another at Ft. Vermilion, were not used in calculations owing to high CV. It also had 1.9% more seed oil the checks but was 0.5% lower in protein contentACS-C29 is slightly shorter than AC Parkland and has good resistance to white rust race 7a (*Albugo candida* (Pers.) Kuntze).

Other Characteristics

<u>Plant Characteristics</u>

Maturity: 86 d, 2 d earlier than AC Parkland and similar to AC Sunbeam.
Height: 90 cm, slightly shorter than AC Parkland.
Lodging resistance: Fair, similar to AC Parkland and AC Sunbeam.

<u>Seed Characteristics</u>

Seed colour: Mixed yellow- light brown, predominantly yellow.
Thousand kernel weight: 2.7 g, greater than AC Parkland.
Saturated fatty acid content: 5.4%.
Erucic acid content: 0.2%.
Glucosinolate content: 12.7 μmol g^{-1} whole seed, on a 8.5% moisture basis.

Availability of Propagating Material

The parents of ASC-C29, TR1, TR3 and TR4 will be maintained by AAFC-SRC, 107 Science Place, Saskatoon, Saskatchewan, S7N 0X2.

Table 1. Performance and quality of ACS-C29 in the Western Canada Canola/Rapeseed Recommending Committee private and public co-operative trials, 2007-08.

Cultivar	Yield (kg ha^{-1}) by year[x] 2007	2008	Mean	Seed oil[y] (% whole seed)	Protein[y] (% whole seed)
ACS-C29	1931	2210	2082	49.6	22.8
AC Parkland	1461	1921	1709	47.8	23.3
AC Sunbeam	1806	2126	1978	47.7	23.3
SED	113	99	74	1.9	0.2
Tests (n)	6	7	13	10	10

[x] 2007 tests grown at two sites at Beaverlodge (early and late planting), two sites near Ft. Vermilion, Fairview and Hines Creek, AB and Fort St. John and Dawson Creek, B.C.; 2008 tests were grown at Didsbury, Fairview, Ft. Vermilion, Westlock, and Penhold, AB and Prince Albert and Glaslyn, SK.

[y] Data combined over 2 years. Near-infrared reflectance according to AOCS standard procedure Am 1-92: Determination of oil, moisture and volatile matter, and protein by near-infrared reflectance using a Foss NIRSystems Model 6500 analyzer. Results are reported on a zero moisture basis.