Canadian Journal of Plant Science
Revue canadienne de phytotechnie

AAC Glenview Sainfoin (*Onobrychis viciifolia* subsp. *viciifolia*)

Journal:	<i>Canadian Journal of Plant Science</i>
Manuscript ID	CJPS-2017-0331.R2
Manuscript Type:	Cultivar description
Date Submitted by the Author:	07-Feb-2018
Complete List of Authors:	Acharya, Surya; AAFC, Lethbridge Research Centre
Keywords:	sainfoin, New cultivar, bloat-free legume, Forage

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*CULTIVAR DESCRIPTION***AAC Glenview Sainfoin (*Onobrychis viciifolia* subsp. *viciifolia*)****S. N. Acharya***Agriculture and Agri-Food Canada, Lethbridge Research and Development Centre,**5403 – 1st Avenue South, Lethbridge, Alberta, Canada T1J 4B1.*

Abstract: AAC Glenview sainfoin tested as LRC 4342 was developed by the Agriculture and Agri-Food Canada (AAFC) Research and Development Centre, Lethbridge, Alberta. This cultivar was derived from parental clones selected for improved forage yield in mixed stands with alfalfa under grazing and regrowth after grazing. When grown under irrigated and rainfed conditions of western Canada, Glenview out yielded Nova (check) by 21% in pure stands over 37 location years and 19% in mixed stands with alfalfa over 17 location years. This cultivar flowers and matures about 8 days earlier than Nova and has slightly larger seed than Nova (24.7 g 1000 seeds⁻¹ vs 20 g). It can be grown for hay and pasture in pure stands but, Glenview is well suited for mixed sainfoin-alfalfa stands. Breeder seed for the cultivar will be produced by AAFC and the multiplication and distribution rights were awarded to Monarch Feeders Ltd., Monarch, AB.

Key words: Cultivar description, sainfoin, bloat-free forage legume

Alfalfa (*Medicago sativa*) is considered the ‘Queen of Forages’ in western Canada because of its wide adaptation, productivity and ability to provide high quality forage. However, fear of pasture bloat limits its use in alfalfa-based pastures (Popp et al. 2000). In

the past, numerous bloat control strategies have been developed, including the breeding of AC Grazeland alfalfa (Coulman et al. 2000) which is considered bloat-reduced not bloat-safe. Sainfoin (*Onobrychis viciifolia*), a high-tannin containing legume, is known to be bloat-safe. Bloat does not occur in sainfoin pastures or when fed fresh to cattle (McMahon et al. 1999; Berg et al. 2000). In addition, this condensed tannin containing legume prevents bloat in grazing cattle when present in alfalfa pasture in adequate proportion (Wang et al. 2006; Sottie et al. 2014). However, old sainfoin cultivars developed for western Canada such as Nova (Hanna 1980) do not persist in alfalfa stands and do not regrow at the same rate as alfalfa after cutting or grazing making the mixed stands risky to graze (Jefferson et al. 1994). To improve the ability of sainfoin to survive in mixed alfalfa stands and regrow at a similar rate as alfalfa the sainfoin improvement program at Lethbridge Research and Development Centre (LRDC) used a screening technique that included screening sainfoin both at the establishment and mature growth stages under a multiple cut/grazing system (Acharya et al. 2013). A number of new sainfoin populations, including the source population (LRC 3519) of Glenview (LRC 4342) were developed using a number of new source populations (Acharya et al. 2013). Since sainfoin is not subject to variety registration in Canada, a Certificate for Eligibility was obtained (Certificate No. 2040-2017 dated Dec. 18, 2017) from the Canadian Seed Growers' Association for AAC Glenview sainfoin.

Origin and Breeding

LRC 4342 is a 200 clone synthetic developed at the LRDC, Alberta. The parental clones were derived from crosses between selections developed from parental materials described in Table 1.

The LRC 3519 sainfoin (the progenitor of LRC 4342) and AC Blue J alfalfa mixed pastures were established on June 19, 2008 for a replicated grazing trial at Lethbridge, AB. The trial was replicated four times. Each mixed pasture (paddock) was 4050 m² and seeded with alfalfa and sainfoin in alternate rows with 18 cm row spacing using a 5 m wide no-till press-wheel type drill seeder (John Deere, Canada). Seeding rates were 5 and 15 kg ha⁻¹ pure live seed for alfalfa and sainfoin respectively, to achieve a 50:50 herbage density. Alfalfa and sainfoin seeds were inoculated using Dormal[®] (Becker Underwood, USA) and Royal Peat (Becker Underwood, Canada) inoculants respectively prior to seeding. At the time of seeding, N and P fertilizer was applied at the rate of 10 and 60 kg ha⁻¹ respectively, to aid in pasture establishment. Perennial and grassy weeds were controlled using glyphosate (N-(phosphonomethyl) glycine) prior to seeding and annual weeds were controlled by mowing the crop twice during the establishment year. Residue was manually removed from the fields. After the establishment year the paddocks were rotationally grazed twice in each year for three years using steers at a stocking rate of 4.0 AUM ha⁻¹ year⁻¹. In all years grazing was done between June and end of September with about a 35 day rest period. At the time of plant selection (fall 2011), the mean proportion of sainfoin in the pasture was ~28%. Selection criteria used was ability to survive in mixed alfalfa stands, rapid regrowth after grazing and high biomass productivity.

Six clones of each selected plants were grown in the greenhouse and in 2012, two clones of each selected plant were planted into a 20 x 20 breeding nursery at Lethbridge using 1 m spacing. Three such nurseries were planted under isolation (at least 200m from any other sainfoin plots) to produce seed and to maximize chance for random intercrossing by

native pollinators. After culling undesirable plants, seed from all three nurseries were bulk harvested and then combined in fall 2012 and designated as LRC 4342.

Varietal Characteristics

Growth habit: Erect growth, comparable to Nova.

Leaves: Dark green, multifoliate leaves with 25 lanceolate leaflets compared to 24 for Nova.

Stems: Stem height at 50% bloom is 92cm vs 83 for Nova, 7 mm thick vs 5 mm for Nova, non-pubescent

Crown type: Medium crown width and depth

Roots: Similar to Nova, branched

Flower color: Same as Nova 100% pink, open pollinated

Flowering date: 37 days to flower compared to 45 for Nova

Regrowth: Rapid regrowth after cutting/grazing, very different from Nova

Pods: Round shape, pubescent, but matures about 8-10 days earlier than Nova

1000 Seed weight: 24.7 g with pod compared to 20 g for Nova

Winter hardiness: Same as Nova, No winterkill observed in western Canada over the past four years although stand decline under a multiple cut system is common

Disease reaction: Moderately susceptible to seed chalcid in storage

Other agronomic characteristics: Tolerates grazing better than Nova, grows back after grazing in mixed stands with alfalfa and so can prevent bloat all summer. Nova does not grow back and so in mixed stands with alfalfa cannot prevent bloat all summer (see Table 5).

Performance and Adaptation

LRC 4342 is suitable for hay, dehydration and grazing in western Canada. This population is specifically suitable for mixed stand grazing with alfalfa in this region. AAC Glenview out yielded Nova up to 21% in pure stands and 19% in mixed stands with alfalfa (Tables 2 and 3). In western Canada the mean total annual dry matter yield of this cultivar under rain-fed conditions over 26 location years was 9.875 t ha^{-1} , and 12.350 t ha^{-1} over 11 location years under irrigation (Table 2). In mixed stand with AC Blue J alfalfa, Glenview produced 11.94 t ha^{-1} DM under rain-fed condition and 13.91 t ha^{-1} under irrigation (Table 3). In another test where performance of sainfoin cultivars were compared with alfalfa cultivars, Glenview performed better with AC Longview alfalfa than AC Blue J alfalfa, although the difference was not significant (Table 4).

Under irrigated conditions with Kayak orchardgrass, Glenview produced 26% greater total dry matter than Nova sainfoin (Table 5). However, under rain-fed conditions mixed stand with orchardgrass, Glenview did not perform as well as Nova.

Over 4 location years seed production for Glenview sainfoin ranged from 600 to 1000 kg ha^{-1} .

Maintenance and Distribution of Pedigreed Seed

Breeder seed of LRC 4342 will be maintained by Agriculture and Agri-Food Canada Research and Development Centre, Indian Head, Saskatchewan. Seed multiplication and distribution rights were given to Monarch Feeder Ltd., Monarch, AB.

Acknowledgement

The author gratefully acknowledges technical support provided by Doug Messenger and Doug Friebe, LRDC field crew and summer students who worked with the forage breeding group during the cultivar development and testing years. The cultivar development work was done using financial contributions from AAFC's Peer-review A-base Initiative. Financial contributions from ALMA and BCRC projects during the testing period are also acknowledged.

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Table 1. Population designation, parentage, country of origin, selection method used and clonal composition of AAC Glenview (LRC 4342) sainfoin.

Population designation	Parent population	Origin	Selection method and number of selected clones used
LRC 3519*	Splendid (Savatti et al. 1994)	Romania	300 individual plants selected after 3 spring applications of 1.0 L ha ⁻¹ of Cheminova glyphosate 356 g/L acid equivalent (Cheminova Canada Inc.) were planted into a nursery at Lethbridge, AB. In Aug. 2005, seed from individual plants were harvested and bulked.
LRC 4342	200 clone synthetic	Alberta, Canada	LRC 3519 was seeded in alternate rows with AC Blue J alfalfa for a grazing trial in 2008 at Lethbridge, AB. The paddocks were rotationally grazed by steers for three years after establishment year. Clones of 200 plants selected for their improved ability to survive in mixed alfalfa stand, rapid regrowth under grazing and biomass productivity were then moved to three breeding nurseries for intercrossing. Seeds from all three nurseries were harvested in bulk and the resulting population was named LRC 4342.

Note: All populations and cultivars are *Onobrychis viciifolia* subsp. *viciifolia*.

*The components of LRC 3519 were selected from nurseries (30 X 30 m²) planted in rows with 1m spacing. Clones from 200 selected plants were planted in 3 separate isolated breeding nurseries in Lethbridge from which seed was harvested in bulk.

Table 2. Mean total yearly dry matter (DM) yield of AAC Glenview and Nova sainfoin in western Canada under rain-fed and irrigated conditions

Rain-fed Locations*	# of Years (Trials)	Total DM Yield (kg ha ⁻¹) and % check		
		Glenview	Nova	% of Nova
Creston	7 (3)	14164	9842	144
Foothills	3 (1)	4457	3414	131
Lethbridge	9 (3)	10430	8690	120
Melfort	2 (1)	8222	8198	100
Rosebank	2 (1)	6512	7899	82
Saskatoon	3 (1)	6964	8065	86
Mean of 26 location years		9875	8221	120
SE		1037	767	
Irrigated				
Locations				
Lethbridge	10 (4)	13216	10614	125
Outlook	1 (1)	3690	4905	75
Mean of 11 location years		12350	10125	122
SE		413	527	
Mean of 37 location years		10611	8787	121
SE		760	549	

*In Creston and Lethbridge plots were harvested three times per year. In Foothills, Melfort, Rosebank and Saskatoon the plots were harvested twice and once in Outlook.

Table 3. Mean yearly total dry matter (DM) yield of AAC Glenview sainfoin and AC Blue J (BJ)* alfalfa mixed stands established at Creston, BC and Lethbridge, AB, under rain-fed and irrigated conditions

Rain-fed Locations	# of Years (Trials)	Total DM Yield (kg ha ⁻¹) and % check		
		Glenview/BJ	Nova/BJ	% of Nova/BJ
Creston	4 (2)	14077	11859	119
Lethbridge	6 (2)	10073	8375	120
Mean of 10 location years		11941	10014	119
SE		642	555	
Irrigated Locations				
Lethbridge	7 (2)	13911	11687	119
Mean of 7 location years		13911	11687	119
SE		298	277	
Mean of 17 location years		12729	10683	119
SE		426	369	

The plots were harvested three times a year and the mean yields represent total yield of all three cuts.

* Acharya et al. 1995

Table 4. Mean yearly total dry matter (DM) yield of mixed sainfoin (Nova¹, AAC Glenview and AAC Mountainview² (MV)) and alfalfa (AC Blue J³ (BJ), AC Grazeland⁴ (GL) and AC Longview⁵ (LV)) stands established in 2009 at Lethbridge, AB, under rain-fed conditions

Mixtures	Total DM Yield (kg ha ⁻¹)						% Nova/ LV
	2011	2012	2013	2014	Mean	LSD	
Nova/ LV	10316	11543	12272	11626	11441	df	100
Nova/ BJ	9619	11831	11208	14317	11744	df	103
Nova/ GL	9753	11776	11364	11857	11188	f	98
Glenview/ LV	12642	13755	14887	15176	14115	a	123
Glenview/ BJ	12296	12416	14047	15433	13548	abc	118
Glenview/ GL	12075	12115	13787	12240	12554	bc	110
MV/ LV	12382	12077	13139	14295	12973	abc	113
MV/ BJ	13023	12517	15024	14188	13688	ab	120
MV/ GL	11127	12411	13750	12375	12416	c	109

This mixed stand experiment was seeded as in a RCBD with four replications and was harvested three times a year. The mean yields represent total biomass (sainfoin/alfalfa) of all three cuts. Sainfoin (15 kg ha⁻¹) and alfalfa (5 kg ha⁻¹) were seeded in alternate rows.

¹Hanna 1980

²Acharya 2015

³Acharya et al. 1995

⁴Coulman et al. 2000

⁵Acharya and Huang 2000

Table 5. Mean yearly total dry matter (DM) yield of Glenview and Nova sainfoin in mixed stands with Kayak* (KY) orchardgrass established at Lethbridge, AB, under rain-fed and irrigated conditions

	# of Years (Trials)	Total DM Yield (kg ha ⁻¹) and % check		
		Glenview/KY	Nova/KY	% of Nova/KY
Rainfed				
Lethbridge	3 (1)	6745	7742	87
Mean of 3 location years		6745	7742	87
SE		712	1080	
Irrigated Locations				
Lethbridge	3 (1)	12235	9742	126
Mean of 3 location years		12235	9742	126
SE		413	750	
Mean of 6 location years		9490	8742	109
SE		916	695	

* Acharya, S. N., Friebel, D. R. and Castonguay, Y. 2005. Kayak orchardgrass. Can. J. Plant Sci. 87: 905–906.

This mixed stand experiment was seeded as in a RCBD with four replications and was harvested two or three times a year under rainfed and irrigated conditions, respectively. The mean yields represent total biomass (sainfoin/orchardgrass) of all cuts. Sainfoin (15 kg ha⁻¹) and Kayak orchardgrass (3 kg ha⁻¹) were seeded in alternate rows.