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'Black Magic'™ (APF-77) Primocane-Fruiting Blackberry

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Abstract

'Black Magic'™ (US plant patented as 'APF-77'), is a thorny (botanically spiny), primocane-fruiting blackberry (*Rubus* L. subgenus *Rubus* Watson) intended for use primarily as a home garden or local-market plant. This unique type of blackberry bears fruit on current-season canes (primocanes) and second-season canes (floricanes), potentially providing for crops in the traditional summer season and an additional late-summer to fall season. This new introduction produces large berries with good flavor, has good productivity compared to some prior primocane-fruiting releases, and exhibits some flower and fruit set heat tolerance on the primocanes compared to other primocane-fruiting genotypes in the Arkansas breeding program. It does not have good postharvest storage potential however, and it is not recommended for the wholesale fresh market.

Origin

'Black Magic'™ resulted from a cross of 'Prime-Jim'® (APF-12) x 'Arapaho' made in 2001 at the University of Arkansas Fruit Research Station, Clarksville (FRS). The original plant was selected 28 July 2003 from a population of 750 plants in a seedling field at the same location. Temperatures above 30-35°C and above usually damage primocane flowers and fruits and limit primocane fruiting at this location, so seedling evaluations are primarily based on floricane fruit characteristics. Of note is that 'Black Magic'™ was selected based on primocane fruits due to good set and fruit development even in high summer temperatures. 'Black Magic'™ was tested as selection APF-77 and originally was identified due to being very healthy plant and producing ripe fruit with excellent flavor and size but soft texture.

Description and performance

After selection, two, 6.1-m plots of 'Black Magic'™ were established at FRS [west-central Arkansas, lat. 35°31'58'N and long. 93°24'12'W; US Dept. of Agriculture hardiness zone 7a (USDA Plant Hardiness Zone Map, 2012)] in summer 2003. Plots were established by moving the original plant along with planting root cuttings collected from the original plant. Observational data were taken on the selection in these plots beginning in 2004 and continued through 2013 for floricane and primocane fruiting (data reported for 2009-2013). Also in the selection field were single plots of primocane-fruiting 'Prime-Ark® 45' along with the floricane-fruiting cultivars 'Natchez', 'Osage', and 'Ouachita' from which observational data were collected during this same evaluation period for comparison. Soluble solids percent was recorded from juice extracted

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from 25 fully ripe berries harvested one time at peak ripeness each year for 2008-2012. Standard cultural practices for erect blackberry production were used including annual pre-emergence and post-emergence herbicide applications, and annual spring nitrogen fertilization (56 kg·ha^{-1} N) using ammonium nitrate (Krewer et al., 2001). 'Black Magic'™ received another application of (23 kg·ha^{-1} N) after the floricane crop was completed, which was in late June in most years. Primocanes were tipped at 1.1 m height in mid-June. Dormant pruning consisted of removing dead floricanes and also removing primocane-tissue to a point below the fruiting/flowering area on the primocanes. The plants received a single application of liquid lime sulfur (94 L·ha^{-1}) at budbreak for control of anthracnose [*Elsinoë veneta* (Burkh.) Jenkins]. Raspberry crown borer (*Pennisetia marginata* Harris) was controlled by a single application of a labelled insecticide in October of each year. The plants were irrigated as needed using overhead sprinkler irrigation.

A trial with two replications was established at FRS in May of 2007. Each 3.1 m plot contained five plants grown from root cuttings spaced 0.6 m apart. The cultivars 'Prime-Ark® 45', 'Natchez', 'Osage' and 'Ouachita' were included for comparison in the trial and data were collected in 2008 and 2009. Cultural management of this trial was the same as that described previously, with the exception of drip irrigation being used. Data on floricane first, peak, and last harvest dates were collected along with average berry weight (25 berries measured at each harvest date for each replication). Data for the replicated trials were analyzed for each year separately as a randomized complete block by the GLM procedure of SAS. Means were separated by t-test.

Postharvest evaluations were done on floricane fruits of 'Black Magic'™ and several other cultivars for 2008 and 2009. The procedures used were developed over a multi-year period in the 1990s where various measurements were taken to develop a system for genotype evaluation for potential shipping (Clark and Perkins-Veazie, 2011). Dry, shiny-black berries (untreated with pre-harvest fungicides) were harvested in the morning into hinged, clear, vented, polyethylene 260 g clamshell containers (Century Corrugated Container, Kilgore, TX). Each clamshell contained on average 20 berries. Two clamshells were gathered from each genotype at two consecutive harvest dates (resulting in four replications). The berries were then stored at 5°C, 80% RH for 7 d. Subjective evaluations were made for firmness, presence or absence of visible mold, leak, or reddening. Each berry was removed from the container, determined to be firm (1) to falling apart (5) by using finger pressure between thumb and forefinger, and placed in rows for each firmness rating. Percent soft berries were those in the 4 and 5 rating categories. Each berry was rolled gently on a white paper towel and counted as leaky if juice spots appeared. For reddening, three or more berry drupelets had to be red in order to be counted as visible reddening. All ratings were converted to percentages based on the total number of fruit in the clamshell. The variables of percent berries decayed, with leakage, and soft were used in a calculation for marketability. The overall performance value was calculated as: 100-[sum (% decayed + % soft (3-, 4-, and 5-rated berries) + % leaky)]. Postharvest data were analyzed by analysis of variance by year and means were separated by t-test.

Additional evaluations were done for 'Black Magic'™ in Pennsylvania, Oregon, and Kentucky. In Pennsylvania, the plants were planted in a high tunnel at the Horticulture Research Farm of the Russell E. Larson Agricultural Research Center at Rock Springs, PA in 2008 along with 'Prime-Ark® 45' and 'Prime-Jan®'. Total and marketable yield along with average berry weight over the season were obtained from the primocanes only in 2009, 2011, and 2012. In 2010 the floricanes were retained and also allowed to fruit. At the Oregon State University North Willamette Research and Extension Center

Table 1. Floricane yield and berry weight (average weight of 25 berries measured three times each year) of 'Black Magic'™ and other blackberry cultivars in a replicated trial at the University of Arkansas Fruit Research Station, Clarksville, established in 2007.

Cultivar	Yield (kg·ha^{-1})		Berry Weight (g)	
	2008[z]	2009[z]	2008[z]	2009[z]
	Floricane harvests			
Black Magic™	13,717 ab	3,777 a	5.9 bc	4.2 de
Natchez	14,137 a	6,759 a	7.8 a	6.2 b
Osage	13,832 ab	8,797 a	5.5 c	4.4 cd
Ouachita	8,800 b	4,888 a	6.1 b	4.7 cd
Prime-Ark® 45	13,142 ab	5,110 a	6.1 b	4.7 cd
	Primocane harvests			
Black Magic™	1,075 a	1,430 a	4.6 a	6.4 a
Prime-Ark® 45	988 a	1,907 a	4.3 a	5.1 b

[z] Mean separation within columns within harvest year by t-test, $P = 0.05$.

(Aurora, OR), a single plot of 'Black Magic'™ was established in 2006 and compared to a 2005-planted plot of 'Prime-Ark® 45'; yield per plant, average berry weight and 5, 50, and 95% harvest dates were recorded for 2008 and 2009. An additional planting was established in 2008 and compared 'Black Magic'™ to 'Prime-Jan®' and 'Prime-Jim®' with the same data collected for 2010 and 2011. In Kentucky in 2006, a trial was planted comparing 'Black Magic'™, 'Prime-Jim®', and 'Prime-Jan®' at the Kentucky State University Research and Demonstration Farm, Frankfort, with data collected including yield, berry weight, and harvest dates on floricanes and primocanes in 2007-2009.

Cane yields. Floricane yields of 'Black Magic'™ in Arkansas in 2008 and 2009 were comparable to other cultivars including 'Prime-Ark® 45' (Table 1). Primocane yields were substantially lower and were similar for 'Black Magic'™ and 'Prime-Ark® 45', and these low yields were due to heat affecting the flowering and fruiting of these plants. It has been shown in field observation in Arkansas, and in a controlled-environment study in Ohio, that high temperatures reduce bud and bloom development and result in low productivity, small berries and low quality fruit in primocane-fruiting blackberries (Clark and Perkins-Veazie, 2011; Stanton et al., 2007). Although observations over the years have indicated 'Black Magic'™ fruits more consistently in high heat conditions, these data do not reflect any gain in this trait compared to 'Prime-Ark® 45'. Yields in Pennsylvania in a high tunnel varied from year to year for 'Black Magic'™ and comparison cultivars, with 'Black Magic'™ having higher yields in 2009 on primocanes compared to 'Prime-Ark® 45' and 'Prime-Jan®'. However, 'Black Magic'™ had substantially lower yields than 'Prime-Ark® 45' for other years of primocane fruiting as well as floricane yield in 2010 (Table 2). Percent marketable yield was usually lower compared to 'Prime-Ark® 45' also. Oregon yield data showed lower yields for 'Black Magic'™ compared to 'Prime-Ark® 45' for 2008 and 2009 for the 2006 planting, but higher yield than 'Prime-Jim®' and 'Prime-Jan®' in the 2008-planted trial (data not shown). Kentucky yield data varied substantially by year due to winter injury to canes, frost damage to buds and flowers, and anthracnose infection. Data for 2009 for primocanes provided some reflection of yield potential, with 'Black Magic'™ having significantly higher yields than 'Prime-Jan®' and 'Prime-Jim®' (Table 3). Overall, yield potential of 'Black Magic'™ exceeded that of 'Prime-Jan®' and 'Prime-Jim®', but not that of 'Prime-Ark® 45'.

Berry characteristics. Average floricane

Table 2. Performance of 'Black Magic'™ and two other primocane-fruiting blackberry cultivars in a Pennsylvania high tunnel planting established in 2008.

Cultivar	Total yield (kg·ha^{-1})	Marketable yield (%)	Berry weight (g)
		Fall 2009[z]	
Prime-Jan®	3,359	67.2	7.1
Black Magic™	5,683	79.2	7.9
Prime-Ark® 45	3,728	75.8	9.9
		Summer 2010[y]	
Prime-Jan®	898	46.3	4.7
Black Magic™	3,960	81.3	6.9
Prime-Ark® 45	4,388	87.3	6.1
		Fall 2010[x]	
Prime-Jan®	999	82.0	6.6
Black Magic™	434	46.9	5.0
Prime-Ark® 45	1,505	89.5	8.7
		Fall 2011[w]	
Prime-Jan®	1,421	66.9	6.1
Black Magic™	2,788	79.7	7.0
Prime-Ark® 45	6,315	84.8	7.8
		Fall 2012[v]	
Prime-Jan®	3,096	64.8	7.5
Black Magic™	1,151	66.8	7.4
Prime-Ark® 45	5,168	78.8	8.2

[z] Primocane fruit harvested 7 Aug. - 15 Oct.
[y] Floricane fruit harvested 19 July - 22 Aug.
[x] Primocane fruit harvested 3 Sept. - 18 Oct.
[w] Primocane fruit harvested 29 Aug. - 1 Nov.
[v] Primocane fruit harvested 31 Aug. - 12 Oct.

berry weight of 'Black Magic'™ in Arkansas was 5.9 and 4.2 g for 2008 and 2009, respectively, comparable to 'Prime-Ark® 45' (Table 1). 'Black Magic'™ primocane berry weight was similar or higher than for 'Prime-Ark® 45', and berry weight and yield were both higher in 2009 due likely to more moderate summer temperatures. Marketable berry weight for 'Black Magic'™ in Pennsylvania was usually larger, over 7 g, and larger than 'Prime-Jan®' but usually smaller than 'Prime-Ark® 45' (Table 2). 'Black Magic'™ berry weight in Oregon was consistently large, 7.8 – 8.2 g over the years and plantings, larger than 'Prime-Jan®' and 'Prime-Jim®' (7.2 g) but smaller than 'Prime-Ark® 45' (9.3 g) (data not shown). Kentucky berry weight for 'Black Magic'™ primocanes for 2009 was 5.9 g, similar to 'Prime-Jan®' but larger than 'Prime-Jim®' (Table 3).

Fruit of 'Black Magic'™ is elongated to blocky, and attractive with a glossy, black finish (Figs. 1 and 2). Fruit shape varies on primocanes, and can be reduced in glossiness and color due to heat in Arkansas but is uniform in more suitable environments. Soluble solids concentration for floricane fruits over five years averaged 10.1% for 'Black Magic'™, similar to or slightly lower than the comparison cultivars (Table 4). Flavor ratings for 'Black Magic'™ (7.8) were higher than for 'Natchez' (7.0) and slightly higher than for 'Prime-Ark® 45' (7.6), but lower than 'Ouachita' (8.6) and 'Osage' (8.2) (Table 4). In the Pennsylvania trial, 'Black Magic'™ was preferred for flavor over 'Prime-Jan®' and 'Prime-Ark® 45'. In Kentucky, 'Black Magic'™ was noted to have very good flavor. Firmness of berries in field observations was lower (6.3) for 'Black Magic'™ than all comparison cultivars (Table 4).

Postharvest evaluations for floricane fruits stored for 7 days at FRS indicated poor postharvest performance for 'Black Magic'™

Table 3. Data for 2009 for 'Black Magic'™, 'Prime-Jim®', and 'Prime-Jan®' established in June 2006 at Kentucky State University.

	Yield (kg·ha^{-1})[z]		Berry weight (g)		Harvest dates (start-end)	
	Floricane	Primocane	Floricane	Primocane	Floricane	Primocane
Black Magic™	--	5,263 a	--	5.9 ab	--	7/23 - 10/13
Prime-Jan®	34.7 a	3,163 bc	1.7 a	4.9 bc	7/2 - 8/6	8/10 - 10/13
Prime-Jim®	5.6 a	1,746 c	0.6 a	4.2 c	7/2 - 8/3	8/6 - 10/13

[z] Numbers followed by the same letter within columns are not significantly different (Duncan's multiple range test $P = 0.05$).

Fig. 1. 'Black Magic'™ fruits on primocane grown in a high tunnel, Pennsylvania.

Fig. 2. 'Black Magic'™ fruits on primocanes in Arkansas in a summer with bloom to fruit development maximum temperatures less than 35°C, showing yield and fruit size potential.

(Table 5). Data for red (reddening of the berries in storage), leakage and softness along with overall rating score were consistently poorer for 'Black Magic'™ compared to most cultivars, particularly those used in the shipping industry such as 'Ouachita'. For this reason, 'Black Magic'™ is not recommended for release as a commercial-use cultivar for the wholesale shipping market where berries require storage.

Phenological Data. Floricane bloom dates for 'Black Magic'™ were the same or near that for 'Prime-Ark® 45' and earlier than the thornless, floricane-fruiting cultivars. This could indicate a lower chilling requirement for this cultivar but that has not been confirmed due to FRS and other test sites being high-chill locations.

Floricane first harvest dates for 'Black Magic'™ were 4-5 days earlier than for 'Prime-Ark® 45', near or slightly later than 'Natchez', and earlier than for 'Ouachita' and 'Osage'. Fruiting period on floricanes varied substantially, with the 2009 period being shorter than in 2008; this could be due to the expression in Arkansas of a characteristic of 'Black Magic'™ that is not seen in most cultivars, the tendency to produce basal-fruiting shoots that fruit after the primary crop but before or with the primocane crop. This "three crop" observation was not seen each year, however, and was likely more pronounced in years when the floricane crop was reduced due to cold damage resulting in more basal buds fruiting.

Primocane first bloom date for 'Black Magic'™ generally was mid to late June in Arkansas but varied from year to year due to summer temperature effects. Primocane bloom was noted to be more intense for 'Black Magic'™ in some years when the entire flowering and fruiting process was halted on many genotypes due to high summer

Table 4. Plant and fruit characteristics of five blackberry cultivars at the University of Arkansas Fruit Research Station, Clarksville with data collected from a 2007-planted replicated planting and observational plots.

Characteristic	Cultivar				
	Black Magic™	Natchez	Osage	Ouachita	Prime-Ark® 45
			2008		
Floricane bloom date[z]					
10% bloom	28-Apr	29-Apr	1-May	3-May	1-May
50% bloom	2-May	1-May	5-May	6-May	4-May
			2009		
Floricane bloom date[zy]					
10% bloom	27-Apr	30-Apr	1-May	2-May	27-Apr
50% bloom	8-May	7-May	8-May	10-May	7-May
			2008		
Floricane harvest date[z]					
First	6-Jun	5-Jun	16-Jun	14-Jun	11-Jun
Peak	19-Jun	9-Jun	30-Jun	7-Jul	26-Jun
Last	14-Aug	10-Jul	24-Jul	31-Jul	19-Jul
			2009		
Floricane harvest date[z]					
First	4-Jun	31-May	12-Jun	11-Jun	8-Jun
Peak	15-Jun	15-Jun	22-Jun	29-Jun	22-Jun
Last	23-Jul	16-Jul	20-Jul	23-Jul	20-Jul
Fruit[x]					
Firmness[w]	6.3 (0.5)[v]	7.8 (0.5)	8.2 (0.5)	8.6 (0.6)	8.2 (0.5)
Flavor [w]	7.8 (0.5)[v]	7.0 (0.7)	8.2 (0.5)	8.6 (0.6)	7.6 (0.6)
Soluble solids (%)[u]	10.1 (1.3)	10.7 (2.1)	11.5 (0.9)	10.8 (0.4)	10.5 (1.0)

[z] Data from 2007 replicated trial. Peak harvest date was when the highest yield was recorded during the harvest period.
[y] 2012 bloom data is shown as the median of 3 replicated blocks of data from a 2010 planted replicated trial.
[x] Rating scale of 1 to 10 where 10 = best.
[w] Means of 5 years, 2009-2013, with data collected on observational plots with (standard deviation).
[v] Missing 2010 data.
[u] The mean soluble solids data from 2008 through 2012 are represented with (standard deviation).

temperatures. Primocane flowering and fruiting were observed late in the season, into October in some years, but was variable in occurrence in Arkansas. In Kentucky, fruiting was observed to be stronger late in the season compared to 'Prime-Jan®' and 'Prime-Jim®'.

Primocane first ripe fruit date was also difficult in some years to fully determine for 'Black Magic'™ in Arkansas but usually was in late June to early July, and fruiting continued in some years with moderate summer temperatures. It tended to ripen earlier than 'Prime-Ark® 45' by up to 14 days (data not shown). In Kentucky, primocane harvest began on 23 July for 'Black Magic'™, earlier than 'Prime-Jan®' and 'Prime-Jim®' (Table 3). 'Black Magic'™ was not found to be earlier in ripening compared to 'Prime-Ark® 45' in Oregon, and in Pennsylvania was earlier than other cultivars in some years but was not consistent in this trend.

Plant Characteristics. Canes of 'Black Magic'™ are erect, similar to 'Ouachita' and more erect than 'Natchez' (data not shown). Vigor rating of 'Black Magic'™ was similar to 'Prime-Ark® 45' (data not shown). No orange rust [caused by *Gymnoconia nitens* (Schwein.) F. Kern & H.W. Thurston] was observed on 'Black Magic'™ in any evaluations, although infected plants were seen

Table 5. Postharvest evaluations of 'Black Magic'™ compared to other blackberry cultivars from 2008 and 2009 at the Fruit Research Station, Clarksville, AR (7 days in cold storage at ~5°C).

Genotype	n	Overall[z]	Red (%)[y]	Leakiness (%)[x]	Decay (%)[w]	Soft (%)[v]
			2008			
Black Magic™	4	-19.9 c	66.1 a-d	47.0 a	6.1 ab	66.7 abc
Natchez	4	35.9 ab	66.6 abc	12.6 b	1.4 b	50.2 bcd
Osage	4	45.7 a	18.4 d	4.5 b	2.8 b	47.3 cd
Ouachita	4	3.4 bc	22.8 cd	15.5 b	11.5 a	69.6 ab
Prime-Ark® 45	4	47.8 a	25.3 bcd	7.5 b	0.9 b	43.8 d
Prime-Jim®	4	-52.7 d	75.3 a	56.0 a	11.0 a	85.7 a
Tupy	4	-0.8 bc	35.0 a-d	39.6 a	1.8 b	59.4 bcd
			2009			
Black Magic™	4	-46.9 b[u]	15.3 b	67.4 a	8.7 ab	70.9 a
Natchez	4	55.9 a	14.4 ab	14.7 b	1.3 b	28.23 bc
Osage	4	65.6 a	1.0 ab	16.3 b	3.0 b	15.13 c
Ouachita	4	27.9 a	0.0 a	35.0 b	3.5 b	33.55 bc
Prime-Ark® 45	5	38.7 a	4.8 ab	29.9 b	3.4 b	27.98 bc
Prime-Jan®	2	37.5 a	4.7 ab	23.5 b	0.0 b	39.05 b
Tupy	5	-45.3 b	12.0 ab	64.0 a	19.6 a	61.8 a

[z] Overall ratings are used as an indicator of performance after 7 d in the cooler. Overall is calculated as: 100 - [sum (% decayed + % soft (3-, 4-, and 5-rated berries) + % leaky)].
[y] The berries were rated on a yes/no scale for presence of red drupelets in clusters of three or more.
[x] The berries were rated on a yes/no scale for presence of leakiness.
[w] The berries were rated on a yes/no scale for presence of decay.
[v] The berries were rated on a 1-5 scale for softness, where 1 = firm and 5 = collapsed berry, very leaky. Means represent berries that scored a 4 or 5.
[u] Means within year and column followed by the same letter are not significantly different ($P = 0.05$) by t-test.

within 30-50 m of data collection plots in each year of evaluation. 'Black Magic'™ berries or canes have not been observed to be susceptible to anthracnose at FRS where a single spray of lime sulfur was applied. Reaction of 'Black Magic'™ to rosette/double blossom [*Cercosporella rubi* (Wint.) Plakidas] has not been conducted as this disease did not occur at any of the test sites.

'Black Magic'™ should be of value as a home garden cultivar with good flavored-fruits with potentially enhanced heat tolerance of the primocanes in flowering and fruiting compared to existing primocane-fruiting cultivars. However, it is not recommended for use where storage of berries is required.

Availability

A US plant patent (No. 24,249, 18 Feb. 2014) has been awarded for APF-77 ('Black Magic'™). It has been licensed to Gardens Alive! for sales in the home garden market through Gurneys Seed and Nursery and Henry Fields catalogs and online stores.

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Mention of trade names or commercial products in this manuscript is solely for the

purpose of providing specific information and does not imply recommendation or endorsement by the US Department of Agriculture, Oregon State University, Kentucky State University, Pennsylvania State University, or the University of Arkansas.

Literature Cited

Clark, J.R. and P. Perkins-Veazie. 2011. Prime-Ark® 45 primocane-fruiting blackberry. HortScience 46:670-673.

Krewer, G., B. Smith, P. Brannen, and D. Horton. 2001. Commercial bramble culture. Bull. 964, Univ. of Ga. Cooperative Extension Serv.

Stanton, M.A., J.C. Scheerens, R.C. Funt, and J.R. Clark. 2007. Floral competence of primocane-fruiting blackberries Prime-Jan® and Prime-Jim® blackberries grown at three temperature regimes. HortScience 42:508-513.

USDA Plant Hardiness Zone Map. 2012. Agricultural Research Service, U.S. Department of Agriculture. Accessed from http://planthardiness.ars.usda.gov. 10 May 2014.

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The effect of temperature, region and season on red colour development in apple peel under constant irradiance

This study reports on red colour development in response to temperature for red and bi-coloured apple cultivars grown in South Africa, but also of global importance. ‘Royal Gala’ (RG), ‘Fuji’ (FJ), ‘Braeburn’ (BB), ‘Early Red One’ (ERO) and ‘Cripps’ Pink’ (CP) were sampled from two production areas, viz. Ceres and Grabouw, in the Western Cape Province of South Africa in the 2007−2008 and 2008−2009 seasons. Peel discs were punched from the shaded sides of fruit, placed on peltier temperature plates set to a temperature range from 16−31 °C with 3 °C intervals and exposed to photosynthetic photon flux (PPF) of 550–650 μmol m^{-2} s^{-1} for 72 h where after their change in hue was determined. The study focused on the effect of temperature on red colour development in the month before the onset of commercial harvest, which is when anthocyanin synthesis peaks in the cultivars grown in South Africa. Although apples from Ceres generally increased more in redness than apples from Grabouw, the general pattern of colour development over the temperature range studied was the same for fruit from both areas. Colour development generally showed a quadratic response to temperature with the greatest change in red colour developing from 19−25 °C in 2007−2008 and 16−22 °C in 2008−2009. Red colour development in RG peaked at a higher temperature range of 22–28 °C in 2007−2008. The response to temperature was less clearly defined in ERO where red colour developed over a broad temperature range and also in RG where differences were not significant in 2008−2009. The lower optimum temperature ranges for red colour development in 2008−2009 compared to 2007−2008 for FJ, BB and CP suggest that climatic conditions during fruit development affect the potential to synthesise anthocyanin. The “adaptation” of anthocyanin biosynthesis to climate may hinder the selection of suitable sites for cultivation of red and blushed cultivars. Abstract from: Anton Gouws, Willem J. Steyn, 2014. Scientia Horticulturae 173:79-85.