

VEGETATIVE AND REPRODUCTIVE PARAMETERS OF INTRODUCED PLUM CULTIVARS

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A B S T R A C T

From 1996 to 2003, five introduced plum cultivars were evaluated at the Plum Experimental Station in Dryanovo, Bulgaria. The cultivars evaluated were 'Opal', 'Čačanska Lepotica', 'Tuleu timpuriu', 'Althan's gage' and 'Anna Spath'. The cultivar 'Stanley', which is widely grown in Bulgaria, was used as the standard.

All of the cultivars were very productive and bore delicious, high quality fruits which are suitable both for eating fresh and for the canning industry. Most of them are tolerant to the *Plum Pox Virus*, *Polistigma rubrum*, *Transzhelia discolor* and *Monilinia laxa*.

Key words: plum, cultivar, growth, size crown, flowering, yield

INTRODUCTION

The plum is a traditional fruit crop in Bulgaria, and is surpassed only by the apple in terms of annual production and orchard area. Half of all the plum orchards in Bulgaria are located near the towns of Lovech, Troyan, Gabrovo, Dryanovo and Elena in the Central Balkan Massif (Djouvinov and Vitanova, 2001).

Until 1985, the main cultivar grown in Bulgaria was 'Kujstendilska sinia sliva'. Recently, there has been a trend to plant new orchards with 'Stanley' (Djouvinov and Vitanova, 2001). Other cultivars, including 'Strinava', 'Gabrovska' and 'Nevena', account for a small percentage of the Bulgarian plum stock (Vitanova and Ivanova, 1995).

The plum cultivars 'Stanley', 'Opal', 'Čačanska Lepotica', 'Althan's gage' and 'Anna Spath' are tolerant to some economic important pathogens such as the *Plum Pox Virus*, *Polistigma rubrum*, *Monilinia laxa* and *Transzhelia discolor*. They bear delicious, high quality fruits which are suitable

both for eating fresh and for the canning industry (Vitanova et al., 1998). 'Opal', 'Čačanska Lepotica' and 'Anna Spath' have also been evaluated in Poland, the Netherlands and Belgium (Grzyb and Rozpara, 1998; Kemp and Wustenberghs, 1998).

When growing introduced plum cultivars, it is very important to determine their main biological characteristics under local conditions, such as the beginning, end and duration of the blossoming period, crown size and fertility.

The aim of this trial was to evaluate the introduced plum cultivars 'Opal', 'Čačanska Lepotica', 'Tuleu timpuriu', 'Althan's gage' and 'Anna Spath' in terms of blossoming period, growth characteristics, fruit quality and fertility when grown the Bulgarian plum producing area in the Central Balkan Massif.

MATERIAL AND METHODS

From 1996 to 2003, five introduced plum cultivars were evaluated at the Plum Experimental Station in Dryanovo, Bulgaria. The cultivars evaluated were 'Opal', 'Čačanska Lepotica', 'Tuleu timpuriu', 'Althan's gage' and 'Anna Spath'. The cultivar 'Stanley', which is widely grown in Bulgaria, was used as the standard.

In the spring of 1990, ten trees of each cultivar grafted on Myrobalan rootstock were planted 5 x 7 meters apart in a pseudopodzolic gray forest soil. Myrobalan is a *Prunus cerasifera* Ehrh. seedling rootstock. The trees were treated with the same agrotechnical methods without the use of irrigation.

The following data were recorded: average fruit weight, average stone weight, stone to fruit ratio, yield, beginning, end and duration of the full blossoming period, blossoming intensity, crown height, crown diameter, crown volume, trunk diameter, and the angle of the skeletal branches to the trunk. Soluble solids content, total sugar content, and organic acids content were also measured.

Fruit parameters were recorded as the average for three kilograms of fruit from each tree.

Soluble solids content was determined by refractometry. Glucose content and sucrose content were measured by Bertran's method. Fructose content was measured by Kolthoff's method. Organic acids content was measured by titration with 0.1 N NaOH.

RESULTS

Results for average fruit weight, average stone weight, stone to fruit ratio, and yield are presented in Table 1. Results for the beginning, end and duration of the full blossoming period are presented in Table 2. Results for crown height, crown diameter, crown volume, and trunk diameter are presented in Table 3.

Table 1. Fruit properties and yield in plum cultivars (1996-2003)

Cultivar	Fruit weight [g]	Stone weight [g]	Stone to fruit ratio [%]	Yield [t/ha]
'Opal'	20.4	0.8	3.92	10.2
'Čačanska Lepotica'	34.8	1.3	3.74	12.6
'Tuleu timpuriu'	35.7	1.2	3.36	15.1
'Althan's gage'	36.2	1.2	3.31	14.5
'Anna Spath'	35.7	1.5	4.20	19.8
'Stanley'	36.6	1.6	4.37	16.1
LSD _{0.05}	7.23	0.3	-	4.78

Table 2. Flowering in plum cultivars (1996-2003)

Cultivar	Beginning of full flowering		End of full flowering		Duration of flowering
	x	±Sx	x	±Sx	
'Opal'	April 11	12.8	April 16	11.6	6 days
'Čačanska Lepotica'	April 10	12.4	April 17	10.9	8 days
'Tuleu timpuriu'	April 11	12.5	April 19	10.4	9 days
'Althan's gage'	April 11	11.8	April 19	10.8	9 days
'Anna Spath'	April 13	12.4	April 21	10.3	9 days
'Stanley'	April 11	12.2	April 19	11.1	9 days

Table 3. Crown size and trunk circumference of plum cultivars (1996-2002)

Cultivar	Crown height [m]	Crown diameter [m]	Crown volume [m ³]	Trunk circumference [cm]
'Opal'	3.01	5.68	24.5	48.0
'Čačanska Lepotica'	3.05	4.82	18.1	42.7
'Tuleu timpuriu'	3.49	5.21	24.8	58.0
'Althan's gage'	3.48	4.01	15.1	37.7
'Anna Spath'	3.15	4.20	13.2	35.7
'Stanley'	3.50	5.01	23.8	46.7
LSD _{0.05}	0.43	0.92	8.06	7.3

'Opal'

In Dryanovo, 'Opal' ripens in the middle of July. It bears medium sized fruits that weigh 20.4 g, much less than for 'Stanley'. Fruit weight is very uniform. Stone weight is 0.8 g.

Total soluble solids content is 17.7%. Total sugar content is 11.6%. Organic acids content is 0.85%.

'Opal' starts bearing early, in the fourth or fifth year after planting. Average yield is 10.2 tons/ha, which is less than for 'Stanley'.

'Opal' is self fertile and blossoms abundantly. On average, full blossoming begins on April 11, about the same time as for 'Stanley'.

'Opal' is more vigorous than 'Stanley', especially in the first four or five years after planting. The crown is pyramidal, and has a less well-defined

central leader than 'Stanley'. 'Opal' requires heavy pruning and fruit thinning so that its fragile branches do not break under the weight of a large harvest. The angle of the skeletal branches to the trunk is 47°.

'Čačanska Lepotica'

In Dryanovo, 'Čačanska Lepotica' ripens at the end of July. It bears large fruits that weigh 34.8 g, about the same size as 'Stanley'. Stone weight is 1.3 g, and stone to fruit ratio is 3.74%.

Total soluble solids content is 18.0%. Total sugar content is 10.6%. Organic acids content is 1.36%.

'Čačanska Lepotica' starts bearing very early, in the third year after planting. Average yield is 12.6 tons/ha.

'Čačanska Lepotica' is self fertile and blooms at the same time as 'Stanley'.

'Čačanska Lepotica' is vigorous. The crown is spherical. Crown height is 3.05 m, crown diameter is 4.82 m, crown volume is 18.1 m³, trunk circumference is 42.7 cm, and the angle of the skeletal branches to the trunk is 48°.

'Tuleu timpuriu'

In Dryanovo, 'Tuleu timpuriu' ripens at the end of July and the beginning of August. It bears very large fruits that weigh 35.7 g. The fruits are very tasty and are suitable for eating fresh, canning and making compote and marmalade. The stone is moderately large and weighs 1.2 g. The stone separates easily from the flesh. Stone to fruit ratio is 3.36%.

Total soluble solids content is 18.6%, nearly the same as for 'Stanley'. Total sugar content is 12.0%. Organic acids content is 0.62%.

Average yield is high, 15.1 tons/ha.

'Tuleu timpuriu' is moderately vigorous. The crown is open and broom shaped. Crown height is 3.49 m, crown diameter is 5.21 m, crown volume is 24.8 m³, trunk circumference is 58.0 cm, and the angle of the skeletal branches to the trunk is 44°.

'Tuleu timpuriu' is self sterile and blooms at the same time as 'Stanley'. The best pollinators are 'Stanley', 'Althan's gage' and 'Anna Spath'.

'Althan's gage'

In Dryanovo, 'Althan's gage' ripens in the middle of August, at the same time as 'Stanley'. The fruits are very large and weigh 36.2 g. The stone is moderately large and weighs 1.2 g. The stone to fruit ratio is low, 3.31%.

Total soluble solids content is 19.9%. Total sugar content is 12.6%, higher than for 'Stanley'. Organic acids content is low, 0.64%.

'Althan's gage' has an average yield of 14.5 tons/ha and bears regularly. The fruits are very tasty and are suitable for eating fresh and for making compote and juice.

'Althan's gage' is vigorous. The crown is dense and broadly pyramidal to spherical. Crown height is 3.48 m, crown diameter is 4.01 m, crown volume is 15.1 m³, trunk circumference is 37.7 cm, and the angle of the skeletal branches to the trunk is 48°.

'Althan's gage' is self sterile and blooms at the same time as 'Stanley'. The best pollinators are 'Stanley' and 'Anna Spath'.

'Anna Spath'

In Dryanovo, 'Anna Spath' ripens in the middle of September. It bears very large fruits that weigh 35.7 g. The fruits are suitable for eating fresh, freezing and for making compote. The stone is comparatively large and weighs 1.5 g. The stone separates easily from the flesh. Stone to fruit ratio is 4.20%.

Total soluble solids content is 18.0%. Total sugar content is 12.4%. Organic acids content is 0.72%.

Average yield is very high, 19.8 tons/ha.

'Anna Spath' is moderately vigorous. The crown is broadly pyramidal. Crown height is 3.15 m, crown diameter is 4.20 m, crown volume is 13.2 m³, trunk circumference is 35.7 cm, and the angle of the skeletal branches to the trunk is 49°.

'Anna Spath' is self fertile.

DISCUSSION

'Opal' and 'Tuleu timpuriu' are very vigorous and have large crowns. They need to be spaced further apart than 'Anna Spath' and 'Althan's gage', which have small crowns.

'Anna Spath' had the highest yields of all the cultivars tested, including 'Stanley'.

'Opal', 'Čačanska Lepotica', 'Tuleu timpuriu', 'Althan's gage' and 'Anna Spath' are tolerant to the *Plum Pox Virus*, the most dangerous disease in plums, which makes them suitable for cultivation in Bulgaria. This agrees with earlier studies (Iliev et al., 1977).

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WZROST I OWOCOWANIE RÓŻNYCH ODMIAN ŚLIW POLECANYCH DO UPRAWY W BUŁGARI

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S T R E S Z C Z E N I E

Doświadczenie prowadzone w latach 1996-2003 w Stacji Doświadczalnej Dryanovo obejmowało następujące odmiany śliw: 'Opal', 'Čačanska Lepotica', 'Tuleu timpuriu', 'Renkloda Althana' i 'Anna Spath'. Kontrolę stanowiły drzewa śliwy odmiany 'Stanley'. Badane odmiany były plenne, a ich owoce miały optymalny skład chemiczny i nadawały się zarówno do bezpośredniego spożycia, jak i do przetwórstwa. Większość z nich jest tolerancyjna na ważne gospodarczo choroby, takie jak szarka (*Plum Pox Virus*), czerwona plamistość liści (*Polistigma rubrum*), rdza śliwy (*Transshelia discolor*) i brunatna zgnilizna drzew pestkowych (*Monilinia laxa*).

Słowa kluczowe: śliwa, odmiana, wzrost, wielkość korony, kwitnienie, plon