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DETERMINATION OF ZONES OF DIFFERENT PLUM GROWING PERIOD LENGTH IN SERBIA

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Abstract: Zoning of Serbia territory was performed according to **t**he length of active period of photosynthesis for plum cv. Požegača. Relations between thermal indicators of location and plum growing period length are examined. It was found that the length of growing period is of great extent, determined by the length of frost-free period, as well as by the mean annual air temperature and the mean air temperature for the growing period.

The study was carried out using data from 55 phenological and 26 climatological stations in Serbia for the period from 1961 to 1995.

Key words: plum, cultivar Požegača, growing period.

I n t r o d u c t i o n

Despite the decline of total tree number in last few decades, aggravation of tree age composition, unfavorable assortment, poor health condition caused by virus sharka (Plum Pox) and smaller income competitiveness compared to other fruit species, plum is still, according to its participation in total fruit production, among the most important fruits in Serbia. Almost all programs and projects of revitalization of plum growing in Serbia include zoning as one of the basic presuppositions for more successful production of this fruit.

Spatial distribution of the growing period is very important for plum zoning, because macrophenological analysis with spatial and temporal distribution of the most important phenophases is, in methodological sense, a necessary element of land-use planning and crop zoning. Since there is no data for other varieties of this fruit, spatial and temporal distribution of cv. Požegača may serve as a marker and indicator of regional influence on phenology of other varieties as well.

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Material and Methods

Determination of zones of different growing period length for plum cv. Požegača is based on phenological observations from 55 phenological stations in Serbia for the period from 1961 to 1995. Požegača is the only plum cultivar which has a representative data set (long enough for sufficient number of stations). Phenological data are shown in two tables. In Table 1a are data for locations where both phenological and climatological observations were made, while data for locations with only phenological data avaliable are shown in Table 1b.

Since the monitoring program of Republic Hydrometeorological Service of Serbia includes only some phenological stages of cv. Požegača, growing period is defined in a narrower sense as an active period of photosynthesis as it was done, for example, by M e n z e l, (2003) in her studies. This period begins with leaf unfolding and ends with general leaf colouring.

Mapping of phenological zones was done by izophens. The degree of correlativity between thermal and phenological indicators is determined using standard statistical methods.

Results and Discusion

The leaf unfolding and the general leaf colouring of plum cv. Požegača in Serbia occur at different times at different locations (Tab. 1a i Tab. 1b). On analyzed locations, the time span between the earliest (April 6 – Minićevo) and the latest mean date of leaf unfolding (May 2 – Zlatibor) is 26 days. The difference between the earliest (September 21– Ljubovija) and the latest mean date of general leaf colouring (October 24 – Knjaževac, Predejanje) is 33 days. Zonal distributions of different times of leaf unfolding and general leaf colouring are presented in Figs 1 and 2.

The beginning of Požegača leaf unfolding is strongly influenced by air temperature in March, the month that precedes this phenological phase. Correlation between mean date of leaf unfolding and mean air temperature in March is very strong and negative, $r = - 0.80$ (Tab. 2). Warmer March causes earlier start of plum growing period, so its leafing begins earlier. Higher temperatures in March usually shift dates of late frost to earlier occurrence. Consequently, correlation between the mean date of leaf unfolding and the mean date of last frost is very high and positive, $r = 0.79$ (Tab. 2). Therefore, these two meteorological parametars may serve as indicators for determination of potential locations suitable for production of fast ripening plum varieties (i.e. Obrenovačka Posavina).

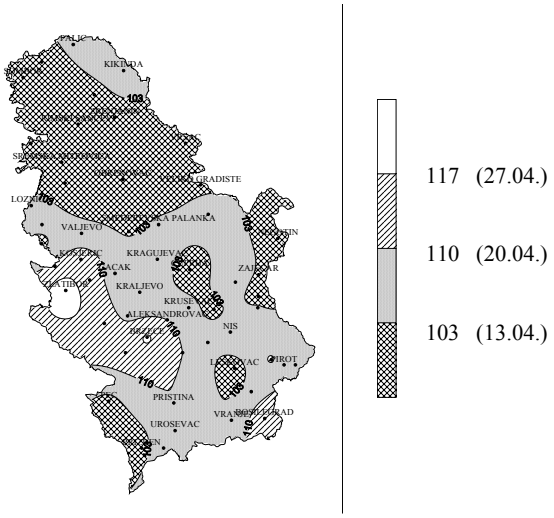

Fig. 1. - Zones of different leaf unfolding time for plum cv. Požegača

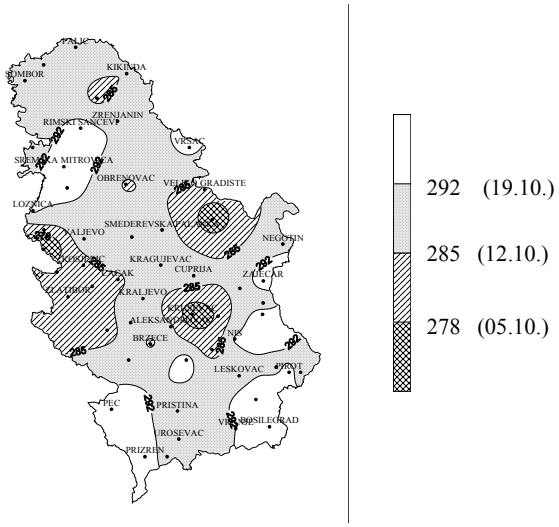

Fig. 2. - Zones of different general leaf colouring time for plum cv. Požegača

T a b. 1a. - Phenological data for plum cv. Požegača and climatological data for selected stations (1961-1995)

Location	Mean date (Julian day)		FA	Mean date (Julian day)		FFP	Mean air temperature (^{0}C)			
	LU	GC		FF	LF		t_{III}	t_{IX}	t_a	t_v
1.Sombor	12.04. (102)	13.10. (286)	184	13.04. (103)	30.10. (303)	200	5.9	16.2	10.7	16.5
2.Palić	14.04. (104)	18.10. (291)	187	05.04. (95)	27.10. (300)	205	5.8	16.6	10.6	16.6
3.R.Šančevi	11.04. (101)	22.10. (295)	194	09.04. (99)	31.10. (304)	205	6.2	16.9	11.1	16.8
4.Zranjanin	11.04. (101)	18.10. (291)	190	10.04. (100)	01.11. (305)	205	6.2	17.1	11	16.9
5.S.Mitrovica	10.04. (100)	23.10. (296)	196	05.04. (95)	29.10. (302)	207	6.4	16.5	10.9	16.6
6.Šabac	11.04. (101)	21.10. (294)	193	05.04. (96)	29.10. (302)	207	6.7	16.7	11	16.7
7.Loznica	14.04. (104)	20.10. (293)	189	04.04. (94)	31.10. (304)	210	6.5	16.6	11	16.6
8.Valjevo	15.04. (105)	16.10. (289)	184	09.04. (99)	24.10. (297)	198	6.1	16.5	11	16.6
9.S. Palanka	14.04. (104)	15.10 . (288)	184	10.04. (100)	22.10. (295)	195	6.2	16.8	11	16.7
10.Vel.Gradište	12.04. (102)	09.10 . (282)	180	09.04. (99)	02.11. (306)	207	6.1	16.8	10.9	16.6
11.Negotin	11.04. (101)	18.10. (291)	190	02.04. (92)	26.10. (299)	207	5.7	17.4	11.2	17.3
12.Zaječar	12.04. (102)	23.10. (296)	194	06.04. (96)	17.10. (290)	194	5.3	16.5	10.4	16.3
13.Ćuprija	09.04. (99)	17.10. (290)	191	15.04. (105)	22.10. (295)	190	6	16.5	10.8	16.4
14.Kragujevac	18.04. (108)	15.10. (288)	180	09.04. (99)	25.10. (298)	199	6.3	16.8	11.1	16.6
15.Požega	21.04. (111)	12.10. (285)	174	22.04. (112)	25.10. (298)	186	5.2	15.2	9.3	15
16.Zlatibor	02.05. (122)	09.10. (282)	160	02.05. (122)	27.09. (270)	148	2.1	13.3	7.2	12.5
17.Kraljevo	13.04. (103)	14.10. (287)	184	08.04. (98)	24.10. (297)	199	6.6	16.9	11	16.7
18.Kuršumlija	20.04. (110)	22.10. (295)	185	19.04. (109)	22.10. (295)	186	5.3	15.5	9.9	15.2
19.Niš	17.04. (107)	20.10. (293)	186	07.04. (97)	30.10. (303)	206	6.8	17.4	11.4	17.2
20.Dimitrovgrad	19.04. (109)	15.10. (288)	179	20.04. (110)	21.10. (294)	184	4.9	15.5	9.8	15.2
21.Leskovac	10.04. (100)	16.10. (289)	189	07.04. (97)	30.10. (303)	206	6.2	16.4	10.8	16.4
22.Vranje	13.04. (103)	19.10. (292)	189	07.04. (97)	01.11. (305)	208	6.1	17	10.8	16.5
23.Uroševac	14.04. (104)	16.10. (289)	185	19.04. (109)	27.10. (300)	191	5	15.8	10	15.6
24.Priština	20.04. (110)	16.10. (289)	179	17.04. (107)	20.10. (293)	186	5.1	15.9	9.9	15.6
25.Peć	11.04. (101)	22.10. (295)	194	03.04. (93)	31.10. (304)	211	6.5	17.3	11	16.8
26.Prizren	10.04. (100)	23.10. (296)	196	31.03. (90)	11.11. (315)	225	7.2	18	11.8	17.6

LU – leaf unfolding, GC – general leaf colouring, FA - length of active period of photosynthesis (mean number of days) FFP - length of frost-free period (mean number of days), t_{III} – average March temperature, t_{IX} – average September temperature, t_a – average annual temperature, t_v – average growing period temperature

T a b. 1b. - Phenological data for plum cv. Požegača (1961-1995) – continued

Location	Mean date (Julian day)		FA
	LU	GC	
27.Aleksa Šantić	11.04. (101)	15.10. (288)	187
28. Kikinda	17.04. (107)	12.10. (285)	178
29. Bečej	11.04. (101)	10.10. (283)	182
30. Šid	11.04. (101)	15.10. (288)	187
31. Vršac	09.04. (99)	21.10. (295)	195
32. Krupanj	15.04. (105)	09.10. (282)	177
33. Ljubovija	11.04. (101)	21.09. (264)	163
34. Obrenovac	08.04. (98)	11.10. (284)	186
35. Bukovička Banja	12.04. (102)	17.10. (290)	188
36. Boljevac	19.04. (109)	15.10. (288)	179
37. Kučevo	15.04. (105)	30.09. (273)	168
38. Minićevo	06.04. (96)	13.10. (286)	190
39. Knjaževac	15.04. (105)	24.10. (297)	192
40. Bajina Bašta	21.04. (111)	12.10. (285)	174
41. Kosjerić	25.04. (115)	10.10. (283)	168
42. Ivanjica	24.04. (114)	09.10. (282)	168
43. Čačak	19.04. (109)	11.10. (284)	175
44. Brzeće	28.04. (118)	11.10. (284)	166
45. Novi Pazar	24.04. (114)	17.10. (290)	176
46. Kruševac	15.04. (105)	29.09. (272)	167
47. Studenica	18.04. (108)	16.10. (289)	181
48. Predejane	15.04. (105)	24.10. (297)	192
49. Aleksinac	11.04. (101)	06.10. (279)	178
50. Aleksandrovac	20.04. (110)	13.10. (286)	176
51. Prokuplje	14.04. (104)	08.10. (281)	177
52. Pirot	15.04. (105)	22.10. (295)	190
53. Babušnica	21.04. (111)	17.10. (290)	179
54. Bosilegrad	27.04. (117)	23.10. (296)	179
55. Brezovica	19.04. (109)	16.10. (289)	180

Compared to leaf unfolding, correlation between the mean date of general leaf colouring and the mean air temperature in September is weaker (Tab. 2). The same findings for influence of thermal conditions on the beginning and the end of growing period were reported by other autors (M e n z e l and F a b i a n, 1999; W i e l g o l a s k i, 1999; Abu-Asabet al., 2001; C h m i e l e w s k i and R o t z e r,

2002; Fitter and Fitter, 2002; Walther et al., 2002; Chmielewski et al., 2004, Črepinšek et al., 2006).

The length of active period of photosynthesis for cv. Požegača varies from 160 days in Zlatibor Mt. to 196 days in Sremska Mitrovica (Tab. 1a). The average length of this period is in strong and positive correlation with the mean annual air temperature and the mean temperature for the period April – October, as well as with the length of frost-free period (Tab. 2).

T a b. 2. - Degree of correlativity between thermal and phenological indicators

Indicator	Correlation coefficient
Mean date of leaf unfolding and mean date of last frost	0,79
Mean date of leaf unfolding and mean air temperature in March	- 0,80
Mean date of general leaf colouring and mean date of first frost	0,42
Mean date of general leaf colouring and mean air temperature in September	0,54
Length of active period of photosynthesis and length of frost-free period	0,82
Length of active period of photosynthesis and mean annual air temperature	0,80
Length of active period of photosynthesis and mean air temperature in period April - October	0,81

Zones of different growing period length for cv. Požegača are shown in Fig 3. The longest growing period (over 187 days) is found in Srem, southern Banat, Posavina, valleys of the rivers Timok and Južna Morava, and Metohija.

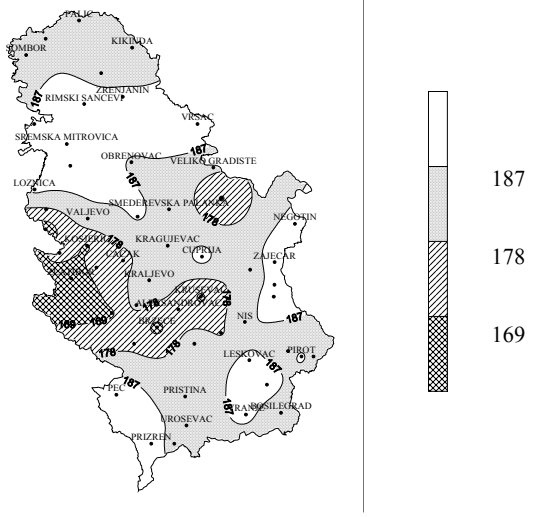

Fig. 3. - Zones of different growing period length for plum cv.Požegača

C o n l u s i o n

The length of active period of photosynthesis for cv. Požegača varies from 160 to 196 days. The leaf unfolding is largely determined by thermal conditions of the environment, but not the general leaf colouring. Long plum growing period is characteristic of locations with high mean annual and mean temperature for the period April – October, and with a long frost-free period.

Locations with high mean air temperature in March and mean date of last frost are potentially suitable for growing of fast riping plum varieties.

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ODREĐIVANJE ZONA RAZLIČITOG TRAJANJA VEGETACIJE ŠLJIVE NA PROSTORU SRBIJE

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R e z i m e

U radu je izvršeno zoniranje prostora Srbije na osnovu srednjeg trajanja fotosinetske aktivnosti listova šlive sorte Požegača. Analizirani su i odnosi toplotnih pokazatelja lokaliteta i trajanja vegetacije ove voćke na osnovu podataka sa 55 fenoloških i 26 klimatoloških stanica u Srbiji u periodu od 1961. do 1995. godine.

Toplotni uslovi sredine u velikoj meri određuju početak listanja ove voćke, ali ne i fenološku fazu žućenja listova. Dugom vegetacijom šljive požegače odlikuju se lokaliteti sa visokim srednjom godišnjim i srednjom vegetacionom (april – oktobar) temperaturama vazduha i dugim bezmraznim periodom.

Mesta sa visokom srednjom temperaturom vazduha u martu i srednjim datumom pojave poslednjeg mraza do 5. aprila, predstavljaju potencijalno povoljne lokalitete za gajenje sorti šljive ranog vremena zrenja.

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