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GROWING REUBENNEL PLUM TREE UNDER SEMIARID CONDITIONS IN NORTHEASTERN BRAZIL

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Abstract

Phenological cycles of crops are sensitive to climatic variation, so their study is important for the evaluation of new crops for fruit production in different regions. In this way, the present experiment was conducted from August to December 2010 with the objective of characterizing the phenological stages and the effective fruiting of plum cv. Reubennel, cultivated in the semi-arid climate of the São Francisco Valley in Northeastern Brazil. Phenological data (stages) were determined in the orchard in daily observations, from bud dormancy to fruit maturity. Under semi-arid conditions the phenological cycle of fruit production of the plum cv. Reubennel was completed in 132 days. It is possible to obtain the production of plum fruits under semi-arid conditions. The continuation of this type of evaluation is necessary to generate a plum production system under semi-arid conditions.

Keywords: Climatic conditions. Chilling requirement. Prunus salicina Lindl.

Introduction

The plum (*Prunus salicina*) has been growing in economic importance, since even with a reduction of 29.62%, between 1998 and 2008, in the volume of imports, this fruit continues to occupy the third place in the ranking of commercial transactions of purchase of fresh fruits made by Brazil. The Brazilian plum area in 2009 was 4,515 ha, with a production of 63,381 t year^{-1}, with Santa Catarina being the main producer state [1].

The production of plum in other regions of Brazil could meet the demand, which was hitherto supplied mainly by the external market, however temperate crops face as main obstacle the lack or insufficiency of cold weather during the winter in most of the Brazilian states. The reduction of fruiting can occur in unfavorable weather conditions where there is a reduction in the viability of the pollen grain. Thus for regions with high temperatures, the use of cultivars with low requirement in cold hours is recommended [2].

The cultivar Reubennel is among the most planted in Rio Grande do Sul. The plant is vigorous, semi-erect, very productive, but susceptible to bacteriosis. The fruit is medium to large in size, the epidermis is yellow-green with red, the pulp is yellow and the cultivar presents low requirement in cold [3].

In order for a species or cultivar to be considered adapted to a producing region, the genetic interaction with the environment in which it is inserted is considered. Therefore, the behavior of the same genotype may vary, depending on the environments in which it is inserted [4]. Thus, phenological studies are an important tool to study the economical viability of the plum tree crop in the Brazilian Northeast, and allows to optimize the cultural treatments through the establishment of the phenological scale of the Reubennel cultivate submitted to semi-arid conditions.

The present work was developed with the objective of characterizing the phenological stages and the fruiting of the Reubennel plum under semiarid conditions in Petrolina, in Northeastern Brazil.

II. Materials and Method

The study was conducted from August 13 to December 22, 2010 in an experimental orchard located at the Bebedouro Experimental Station, belonging to the Brazilian Agricultural Research Corporation (Embrapa Semiárido), in Petrolina-PE (9°09'S, 40° 22'S and altitude of 365.5 meters above sea level). According to [5], the climate of the region is

tropical semi-arid, with annual average temperature of 26ºC, annual rainfall of 550 mm, concentrated between January and April and 3,000 hours of sunshine per year.

During the experiment the temperature (ºC), relative increase (%), mean global radiation (y^{-1}) and rainfall (mm) were collected at the automatic station located at the experimental station (Figure 1).

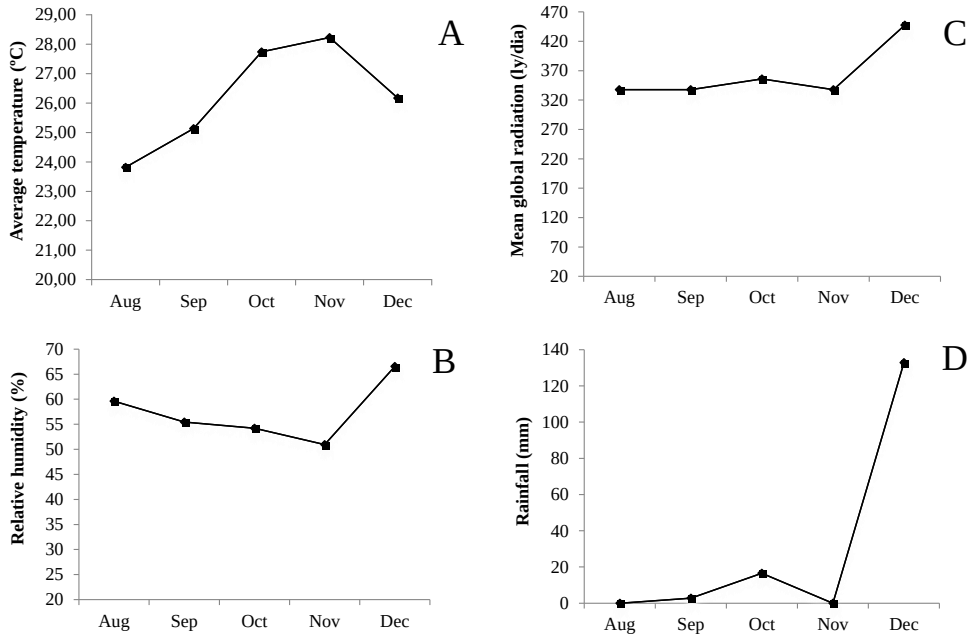

Figure 1. Average temperature (A), relative humidity (B), mean global radiation (C) e rainfall (D) during the period from August to December 2010.

The installation of the orchard was carried out with seedlings of the bare root type of cv. Reubennel grafted on Okinawa rootstock, planted in January 2008, conducted in a 'central leader' system. The planting spacing is 6.0 m between rows and 3.0 m between plants and the drip irrigation system with double rows, with ten emitters per plant (2 L h^{-1} flow). The daily irrigation slides were calculated based on the evapotranspiration recorded by the Bebedouro Meteorological Station and corrected according to the crop coefficient (Kc) of the plum tree. The soil of the study area is classified as dystrophic yellow argisol, medium/clayey texture [6]. Fertilization of the orchard was performed according to [7]. In the first year pruning was performed, in the second year, before pruning was done pruning and bending of the branches to stimulate the development of the buds.

The defoliation of the plums was carried out on July 29, 2010, followed by pruning to eliminate excess branches. The dormancy was exceeded with the application of hydrogen cyanamide (Dormex®) at 0.8%, associated with mineral oil (Assist®) 2.0% (August 12, 2010), applied with a costal spray, when the plants were in the dormant gemstones stadium.

For the conduction of the work, five plants were selected, from which four branches were randomly chosen in each, the phenological behavior of cv. Reubennel was evaluated through visual observations performed daily from pruning and overcoming dormancy until harvest. The determinations of the phenological stages were based on the apple dormant gemstones scale (*Malus domestica*) adapted by [8]: A: dormant gem; B: swollen gemstone; C: budding; D: white button; E: full bloom; F: petal fall; G: effective fruiting; H: developing green fruit; I: mature fruit (Figure 2). The duration of each phenological stage was recorded in number of days.

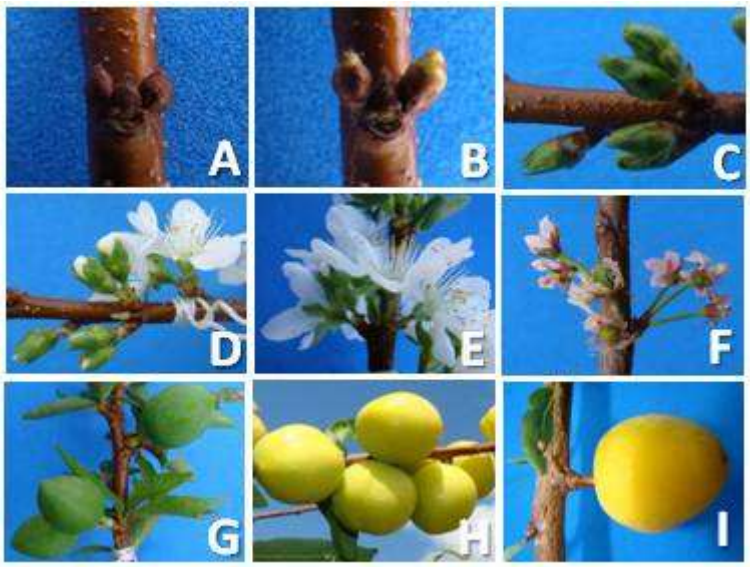

Figure 2. Sequence of the phenological stages of cv. Reubennel, Petrolina - PE, 2010.

A: dormant buds; B: swollen gemstone; C: budding; D: white button; E: full bloom; F: petal fall; G: effective fruiting; H: developing green fruit; I: mature fruit.

The phenological stages were expressed as a percentage. The climatic data and phenological phases were submitted to the simple correlation performed with the Assistat® Program.

III. Results and Discussion

In semi-arid conditions the plum cv. Reubennel concluded the phenological stages, reaching the fruiting, even though they were not subjected to temperatures lower than those recommended by [9] and [10], who report the need for the accumulation of cold hours below 7 ° C during the cold season, so that temperate fruit trees can overcome dormancy. However, the plum cv. Reubennel when submitted to semi-arid conditions requires mechanisms to overcome the dormancy of the buds, for which the use of hydrogen cyanamide was used in this work.

The duration between stages A and I of the Reubennel plum was 132 days (Table 1), a result similar to that obtained by [11], in a study carried out in subtropical regions of the State of São Paulo, where the cv. Reubennel started 130 days after the dormancy was overcome and the results of [12], in which this cultivar completed its cycle in 134 days in Pelotas, RS. While in the Serra da Mantiqueira the Reubennel was sprouting the harvest in only 85 days [13].

Table 1 - Mean duration of the stages of floral induction until the harvest of fruits of the plum cv. Reubennel and number of gemstones developed. Petrolina - PE, 2010.

Phenophases	Days	Bud
A	1	145
B	11	42
C	14	42
D	16	21
E	18	21
F	28	9
G	35	6
H	118	6
I	132	6

A: dormant buds; B: swollen gemstone; C: budding; D: white button; E: full bloom; F: petal fall; G: effective fruiting; H: developing green fruit; I: mature fruit.

It took 18 days for the gemstones to leave the dormant gemstones stage and reach the full bloom stage. The flowering period (D to F) lasted 12 days, a result similar to the mean of 8.1 days obtained in the study with selections of plums conducted by [14]. An effective fruiting

index (G) of 4.13% was registered, in relation to the number of buds evaluated (Table 1), for the Princesa apple tree cultivated under the same climatic conditions was registered 2.33% in 2008 and 10.2% in 2009 [8], demonstrating that this value may increase over the growing years. The longest stage was from G to H, which lasted for 83 days and corresponded to fruit formation, whereas it took another 14 days for fruit ripening (Table 1).

The formation of the plant in the first years is fundamental to the success of the orchard, so a good sprouting of buds allows the selection of well-formed and better distributed branches [15]. In Table 1 it can be seen that of the number of buds evaluated, 29% sprouted (C), which represents an important index for the development and good formation of the orchard. According to [16], after overcoming dormancy the development and growth of the plant is driven mainly by temperature, which contributes to the good orchard formation.

Phenological stages correlated positively and significantly only with mean global radiation and rainfall (Tables 2).

Table 2 - Simple correlation coefficients (r) between the climatic factors and stages of the plum cv. Reubennel in 2010. Petrolina-PE, Brazil.

	Phenophases[1]	Temperatura[2]	UH[3]	Radiation[4]	Rainfall[5]
Phenophases[1]	-	0.6169^{ns}	0.2343^{ns}	0.9854**	0.7255*
Temperature[2]	-	-	-0.5825^{ns}	0.6091^{ns}	0.0896^{ns}
UH[3]	-	-	-	0.2115^{ns}	0.6894*
Radiation[4]	-	-	-	-	0.6738*
Rainfall[5]	-	-	-	-	-

[1]: Duration of phenological stages; [2]: Average air temperature; [3]: Relative Humidity; [4]: Average Global Radiation; **: significant at 1% probability; *: significant at 5% probability; ^{ns}: not significant.

Diverging from the result obtained by [16], in a field study with apples in Germany, in which all stages correlate with mean temperature, indicating that higher temperatures directly after dormancy overcoming can accelerate development processes and finally lead to a advancement of the phenological cycle.

The results of the present study disagree with those reported by [17], which explain that the positive correlations between phenological phases and temperature, changes in the

cultivation environment, as well as in the average temperature, lead to changes in the phenological stages. Similarly, [18] explain that the phenological development of plants and fruit production are influenced by climatic conditions, mainly air temperature, which could explain the divergence of the results of temperate climate for semi-arid climates, as well as alterations of the phenomena between the years under study.

The plants of the present study were transplanted in 2008 and evaluated in 2010, being therefore common that the first harvest presents low rates of fruit glue (4.13%). In this way, the continuous evaluation of the next phenological cycles will be crucial to determine and to consolidate the viability of plum production of cv. Reubennel under semi-arid conditions in Northeast Brazil, since the preliminary results are satisfactory.

IV. Conclusion

The results obtained in this study indicate that: i) it is possible to produce Reubennel plum in tropical semiarid condition; ii) the phenological cycle of fruit production of the Reubennel plum tree in tropical semiarid condition in 2010 lasted 132 days with an effective fruiting of 4.13%; iii) more studies over the years will be necessary to generate a plum production system in the São Francisco Valley.

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