



Climate change affects blueberry production in Romania

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INTRODUCTION

Worldwide, the climate change expression becomes more popular among fruit growers. In blueberry sector, different researchers remark the presence of major changes in the environment and the plants reactions. Sometimes, there are special years when extreme climate factors occur and affect developing phenophases (Salazar, 2012), production (Bădescu, 2009) and normal vegetation (Marciniak and Urban). Environmental changes are in focus of blueberry breeders too. They start looking at the global warming that affect well old adapted cultivars in terms of plasticity to perform normally in a range of new conditions (Lobos and Hancock, 2015).

MATERIALS AND METHODS

Considering the blueberry production fluctuations recorded after 1999 and the occurrence of atypical weather based on meteorological data recorded from 1950 to 2000, we proposed to analyse the dominant meteorological phenomenon that affect blueberry production. In this regard, it were analysed individual yields obtained at 'Blueray' (2000-2015) planted in an experimental field established in 1981 at a density of 3571 plants/ha. The meteorological data were recorded using the Research Unit weather station.

For a better understanding of how climate change interferes, the entire database of the Bilcesti Research Unit was utilised, a multiannual and monthly precipitations mm and temperatures evolutions being interpreted.

Hail of June 21, 2014

Although rainfall in most years is registered with hail, they generally affect in small extent the blueberry production in Bilcesti. But on June 21, 2014 occurred an unusual phenomenon for the area. Between 14:10 and 17:30 hours, a torrential rain with several rounds surprised, the rain has been accompanied by hail four times. The phenomenon has had an important impact on blueberry plants, due to the long duration of over 18 minutes accumulated in four rounds, but also due to the density and size of ice formations. The consequences were worsened by ice formations that have sizes up to 25-30 mm, but especially of the irregular shape, as angular part of the ice formations. This hail has less affected the fruits load by shake losses, this being estimated between 6 and 10%. The bigger damages were counted by large lesions identified on the fruit remaining (Figure 5), a phenomenon that has affected between 65 and 96% of fruit depending on their location in the bush. Determinations made after the manifestation of this phenomenon and after each harvest, was evaluated by a quantitative decrease of 8.6% and a qualitative depreciation of 76.6% of harvested fruit.



Figure 5. Fruit lesions caused by hail fall in 21th of June, 2014

Hail of June 14, 2015

In 2015, a similar phenomenon with the one occurred in 2014 has been remarked. On June 14, between 13:20 and 18:40 afternoon hours, a torrential rain started on several rounds, rain accompanied by hail for a total of 38 minutes duration. Such a long hail rain never happened in the past in Bilcesti. Ice formations have sizes up to 10 mm (Figure 6) and comes in five of the six innings that was manifested. In one round of a six minutes duration, the ice formations had large parties of up to 35mm. Based on calculations made, it was assessed a quantitative decrease of production of 52.6% and a quality depreciation of 45.3% from the remaining fruit on the plants.



Figure 6. Hail rainfall in June 14, 2015

CONCLUSIONS

- Between 1968 and 2000, blueberry crops were affected only accidentally by adverse climatic phenomenons.
- During the period 2000-2015, the frequency of weather events affecting the blueberry crop has increased significantly, been registered in 6 out of the 16 years analyzed.
- Hydric deficit in 2000, 2007 and 2012 years resulted in average production loss of over 53% in 4 out of the 16 years.
- Atypical hail occurred in 2014 and 2015 have resulted in reduction of production by shaking of 8.6% and 52.6% respectively, and in fruits quality depreciation rate of 76.6% in 2014 and 45.3% in 2015.
- Drought and hail climatic phenomena conducted to losses per hectare valued between \$ 5,016 and \$ 17,556 in 6 of the 16 years analyzed.
- Weather events associated to climate change impose the need of blueberry irrigation even in areas with rainfall of over 800 mm and a reassessment of the hail systems presence in the blueberry plantations.

RESULTS AND DISCUSSIONS

The researches made at Bilcesti during the last 25 years reveal the high productivity of blueberry cultivar 'Blueray' which realised an average production of 10-12 t/ha. At the same cultivar and in the same experimental plot it was noticed a variable production of blueberries that varied from 1.68 t/ha in 2001 to 14.03 t/ha in 2010. The weather data collected between 2000-2015 conduct to identification of prominent climate phenomenons as the direct causes of production losses.

Thus, the major climate phenomenons which affected the blueberry production were: the drought from 2000 especially between 1st of June to 31th of August; the drought from June, 2007 and July-August, 2012; hail on 21th of June 2014 and 14 June, 2015.

Drought of 2000

Year 2000 is the only one (from 1950 when meteorological station operates from Bilcesti) when the annual rainfall was below 500 mm (Figure 1); the normal annual rainfall for the region is over 780 mm. The low amount of precipitation fall in this particular year (2000) was determined largely by the deficit rainfall from June to August, which was nearly 200 mm (Figure 2). This has had the immediate effect on the fruits size throughout the harvesting period, mostly in the last harvests, which led to a decrease of production in 2000 by about 30%. But the drought has had more serious consequences for the production of next year. The hydric deficit started competition between growth and fruiting processes and has resulted in a significant reduction of annual growths. Although rainfall in 2001 was of 1123 mm, water stress of the previous year caused a production loss of over 80%.

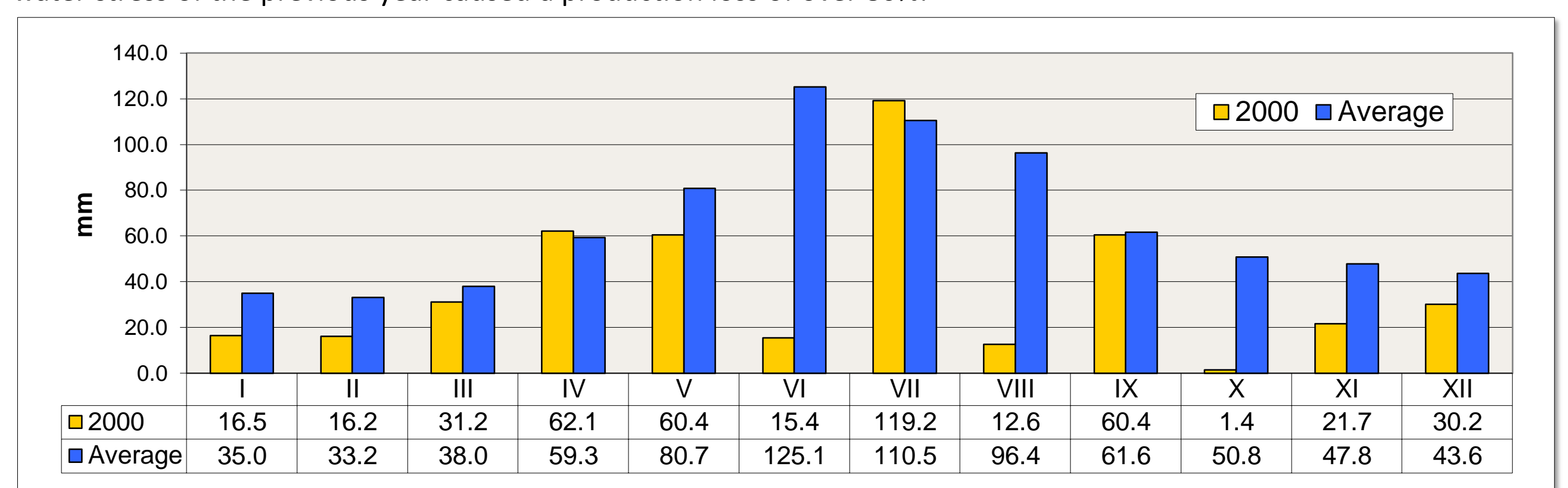


Figure 1. Rainfalls distribution in 2000 comparing to multiannual average values

Drought of July, 2007

Rainfall in 2007 was of 686.7 mm, with a deficit of about 100 mm against the normal area supply. Blueberry production was significantly affected because most of this deficit was recorded in July, when the plants manifest a very high requirements. The extremely low precipitation in July 2007 (Figure 3), of only 19.5 mm compared to the normal level of over 110 mm, shortened harvest time about 15 days, the last harvest registering on August 21 (Figure 4). Water scarcity has resulted in reduction of the harvesting of fruit in the second decade of August and disruption of growth and maturation of fruits starting with the second decade of August. Based on the determinations made, it was evaluated a reduced yields due to the phenomenon by around 53%.

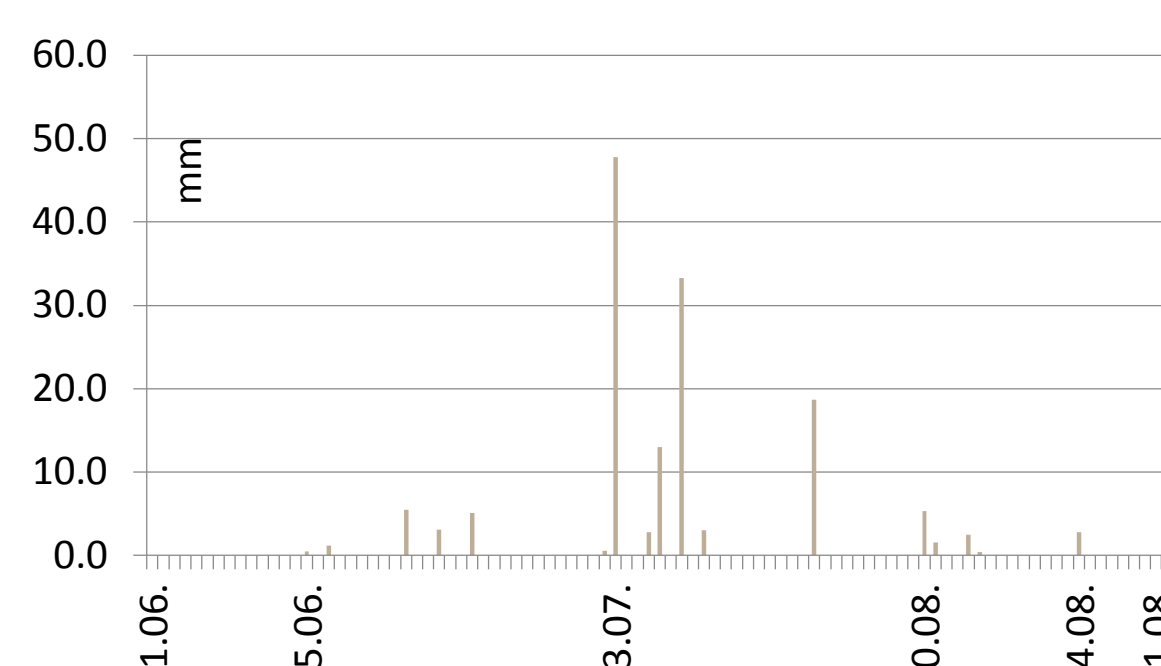


Figure 2. The rainfalls quantities and moments between 1.06.2000-31.08.2000

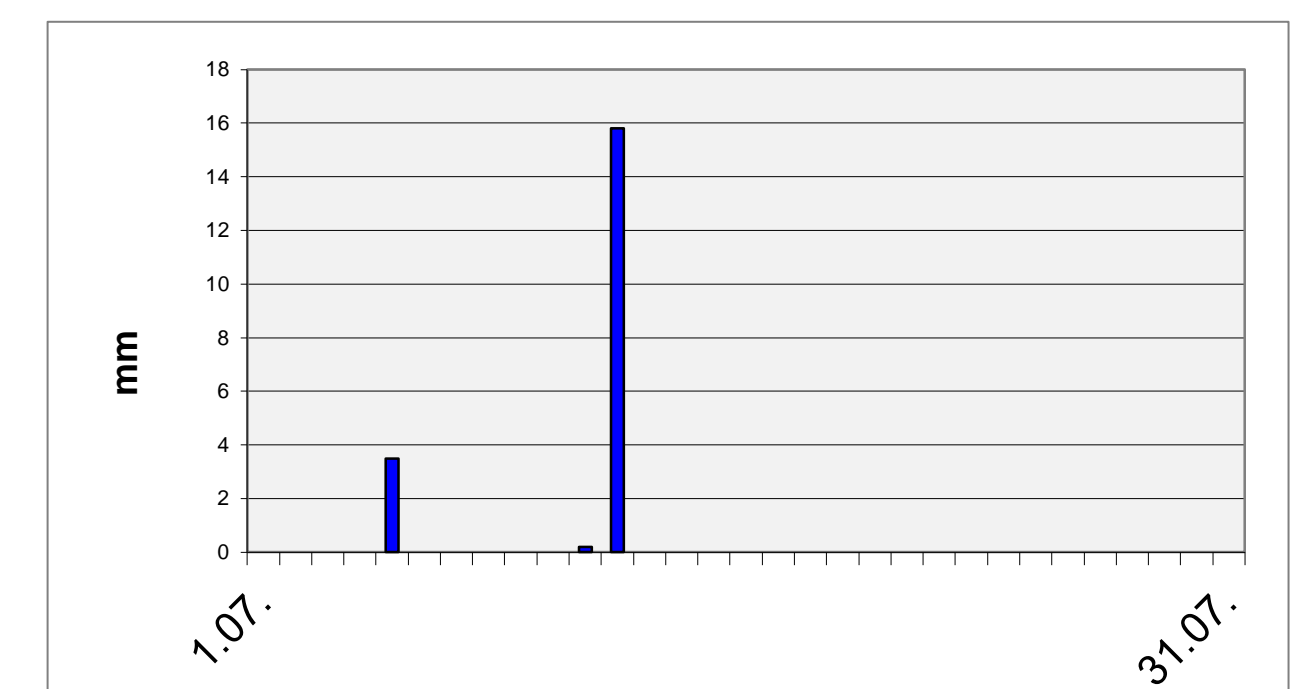


Figure 3. Historical minimum of rainfall in Bilcesti area (19.5 mm, 2007, July)

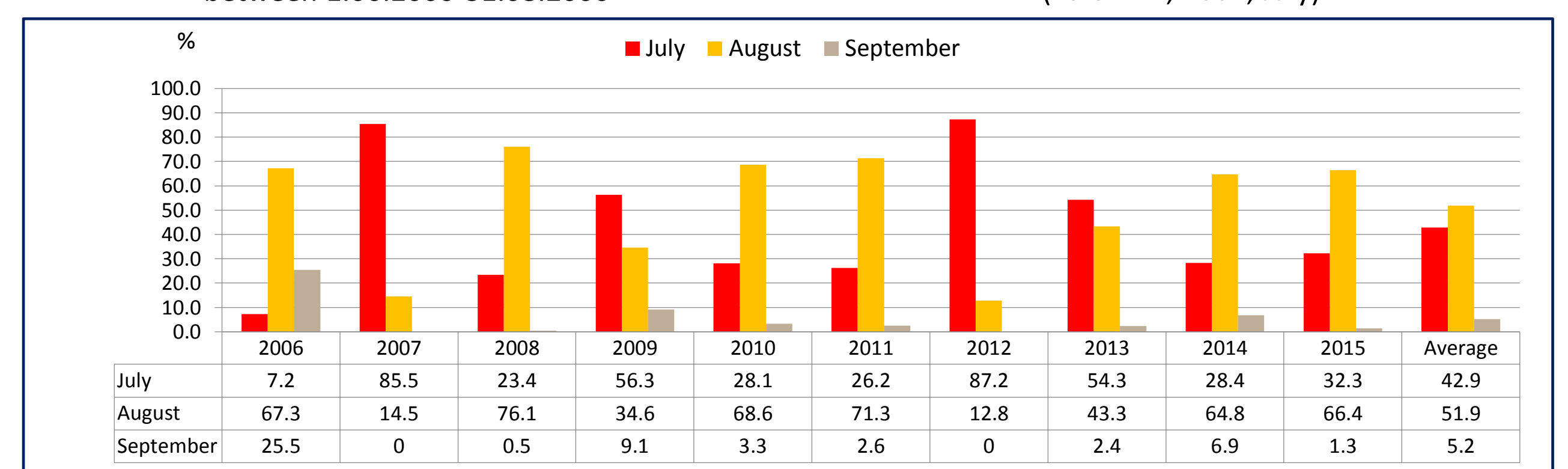


Figure 4. Share of the harvested blueberries at ripening time (2006-2015)

Drought of August, 2012

In 2012 we faced a situation somewhat similar to that of 2007. Although the annual rainfall coantum was pretty close to normal levels, totaling 753,3 mm, but the rainfall distribution was unbalanced. During the period 1 June to 31 August 2012, rain falled only 151,8 mm compared to normal of 332 mm. The effects of water stress was exacerbated by heavy concentration of the rains within very short time in all three months. In this year, much of the blueberry fruits have not reached rippen maturity, the harvest period ending prematurely on August 20, with a consequent reduction in the level of production by 51%.

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