Article **Journal of Urban and Sustainable Development**
December 2022 Vol.8 No.23 31-35

Adaptation of blueberry crop (*Vaccinium corymbosum)* under macro-tunnel in Valle de Santiago, Gto.

Adaptación del cultivo de arándano (*Vaccinium corymbosum)* bajo macrotúnel en Valle de Santiago, Gto.

CALDERÓN-RUIZ, Alberto†*, AGUILAR-LÓPEZ, María Guadalupe, MARTÍNEZ-CAMACHO Adriana Paola and VARGAS-ESPINOZA, Everardo

Universidad Tecnológica del Suroeste de Guanajuato, Carr. Valle-Huanímaro km 1.2 Valle de Santiago, Gto. CP. 38400

ID 1st Author: *Alberto, Calderón-Ruiz* / **ORC ID**: 0000-0002-1721-2953, **CVU CONACYT ID**: 627274

ID 1st Co-author: *María Guadalupe, Aguilar-López*/ **ORC ID**: 0000-0002-2145-1607

ID 2nd Co-author: *Adriana Paola, Martínez-Camacho* / **ORC ID**: 0000-0003-1970-4633, **CVU CONACYT ID**: 714204

ID 3rd Co-author: *Everardo, Vargas-Espinoza* / **ORC ID**: 0000-0002-1238-7981, **CVU CONACYT ID**: 384590

DOI: 10.35429/JUSD.2022.23.8.31.35 Received: March 30 September,; Accepted December 30, 2022

Abstract

In order to evaluate the adaptation of Ventura variety blueberry (*Vaccinium corymbosum*) cultivation under macro tunnel, an experiment was established at the Southwest Technological University of Guanajuato from January to April 2022. The study was established based on a completely randomized experimental design with five treatments and four repetitions. The treatments to be evaluated were four foliar fertilizers: Citan® (rooting hormones); formula 20-30-10 (N, P, K + Microelements); Bayfolan Forte® (N, P, K + Microelements); Demeter Poto® (K, B, Zn, P), applied weekly and an absolute control. The number of green sprouts developed three months after the first application was evaluated. The statistical analysis showed that there were no significant differences ($p = 0.01$) between the foliar fertilization treatments; however, an average of 13 to 16 green sprouts was counted, all with good development, vigor and physical appearance; largely due to foliar fertilization as a complement to nutrition via irrigation. The adaptation of the blueberry crop was achieved, as a recently introduced species in Valle de Santiago, under macro tunnel conditions, the microclimate and implemented agronomic management; however, it is necessary to improve some management aspects such as nutrition and above all, provide optimal protected conditions for cultivation.

Blueberry, Macro tunnel, Adaptation, Foliar fertilization

Resumen

Con el objetivo de evaluar la adaptación del cultivo de arándano (*Vaccinium corymbosum)* variedad Ventura bajo macro túnel, se estableció un experimento en la Universidad Tecnológica del Suroeste de Guanajuato de enero a abril del 2022. El estudio se estableció con base en un diseño experimental completamente al azar con cinco tratamientos y cuatro repeticiones. Los tratamientos a evaluar fueron cuatro fertilizantes foliares: Citan® (hormonas enraizadoras); fórmula 20-30-10 (N, P, K + Microelementos); Bayfolán Forte® (N, P, K + Microelementos); Demeter Poto® (K, B, Zn, P), aplicados semanalmente y un testigo absoluto. Se evaluó el número de brotes verdes desarrollados al cabo de tres meses después de la primera aplicación. El análisis estadístico demostró, que no hubo diferencias significativas ($p = 0.01$) entre los tratamientos de fertilización foliar; sin embargo, se logró contabilizar en promedio de 13 a 16 brotes verdes, todos con buen desarrollo, vigor y apariencia física; en buena medida debido a la fertilización foliar como complemento a la nutrición vía riego. Se logró la adaptación del cultivo de arándano, como especie de reciente introducción en Valle de Santiago, bajo condiciones de macro túnel, el microclima y manejo agronómico implementado; sin embargo, es necesario mejorar algunos aspectos de manejo como la nutrición y sobre todo, brindarle las condiciones protegidas óptimas para el cultivo.

Arándano, Macro túnel, Adaptación, Fertilización foliar

Citation: CALDERÓN-RUIZ, Alberto, AGUILAR-LÓPEZ, María Guadalupe, MARTÍNEZ-CAMACHO Adriana Paola and VARGAS-ESPINOZA, Everardo. Adaptation of blueberry crop (*Vaccinium corymbosum)* under macro-tunnel in Valle de Santiago, Gto. Journal of Urban and Sustainable Development. 2022. 8-23: 31-35

† Researcher contributing as first author

Introduction

Bilberry is a crop native to North America with expanding production and consumption worldwide (Rodriguez, 2019). According to García (2018), the term blueberry refers to the small fruit of some *Vaccinium* species.

Mexico is one of the soft fruit producing countries, year after year the number of hectares cultivated with strawberries, blackberries, raspberries, blueberries and others is increasing. According to SAGARPA (2017), for this same year, Mexico became the third largest producer of blueberries and strawberries in the world. Although, a few years ago in Guanajuato, there was not much interest in berries, today they have a well-earned place in the country's agro-industrial sector.

The project consisted of evaluating the adaptation of the blueberry (*Vaccinium corymbosum*) and its response to the development of vegetative shoots, under the climatic and infrastructure conditions available at the Technological University of Southwest Guanajuato, in Valle de Santiago, Gto. Due to its geographic location and soil and climatic conditions, it is an area with potential for the establishment and production of blueberry; in addition, being a crop established for the first time at the university, it serves to demonstrate and disseminate to producers the results obtained in this first year of establishment and to be able to continue to maintain the crop to carry out future work.

Literature review

In the context of the agricultural production system, adaptability plays a relevant role, due to the processes that must be adjusted so that monocultures and non-traditional crops can be linked in order to obtain alternative products.

The effective management of the different agricultural production systems will allow the correct adaptability of crops in the selected areas to develop their production and obtain the desired productivity (Caicedo, 2020).

According to Rivadeneira (2007), the blueberry production cycle is annual; during this cycle, the following phenological stages occur: vegetative stage (green tip, sprouting, new shoot, new branch, formed branch; and reproductive stage (swollen bud, open bud, flower buds, full flowering, fruit set, green fruit, pink green fruit and ripe fruit).

Casas (2017), points out that in order to take into account the probable areas of adaptation and that the blueberry can adapt adequately, different criteria must be analysed, such as maximum temperatures, minimum temperatures, rainfall, the pH of the soil or substrate, the cloudiness of the place and areas with higher cold temperatures.

In terms of soil and climate requirements, blueberry cultivation requires:

– Soil or substrate: light with good drainage, high porosity, deep and high organic matter content (Intagri, 2017).

– pH: limited to acid pH, the optimum range is 4.5 to 5.5 maximum (Gough, 1994).

– Chilling hours: between 100 and 400 to break the winter dormancy (Gordo, 2008).

– Temperature: Once dormancy is over, it becomes sensitive to low temperatures, especially during flowering. The optimum temperature for root growth is 18 to 22 °C; for shoots, leaves and fruit between 20° and 26°C (Morales, 2017).

– Light: excess light causes a shortening of the fruit ripening period, concentrating the harvest and promoting lower quality fruit. Conversely, cloudy days stimulate the development of fungal diseases that affect fruit condition and yield (INIA, 2017).

– Relative humidity: requires an optimum of 65 to 85 %.

In terms of water needs, due to the presence of very shallow roots, blueberries are sensitive to both water deficit and excess.

ISSN 2414-4932

To meet the crop's water requirements, an irrigation system must be in place (INIA, 2017). Regarding nutrition, according to Undurraga (2013), blueberry is not very demanding in fertiliser requirements and can be damaged if these products are applied in excess.

Materials and methods

Location of the project

The project was carried out from January to April 2022 in the experimental plot of the Universidad Tecnológica del Suroeste de Guanajuato, located in the municipality of Valle de Santiago, Gto., at Km 1.2 of the Valle-Huanímaro highway, at the coordinates 20° 24' 1.04" north latitude and 101° 13' 19.52" west longitude. The area earmarked for the project was 30m^2.

Establishment of plant material

Forty one-year-old blueberry plants of the Ventura variety with a renewal pruning, which were donated by the company Cravo Equipment LTD, were evaluated. The plants were established under a macro-tunnel, in plastic pots with a capacity of 15 L and in coconut fibre substrate mixed with perlite. The crop was established in four rows at a distance of 1.25 m between them and 60 cm from plant to plant.

Experimental design and data analysis

The experiment was established under a simple completely randomised experimental design with five treatments and four replicates, evaluating two plants per replicate. The treatments consisted of four different foliar fertilisers: Citan® (rooting hormones); formula 20-30-10 (N, P, K + microelements); Bayfolan Forte® (N, P, K + microelements); Demeter Poto® (K, B, Zn, P), with a total of five weekly applications; and an absolute control. The data were analysed by analysis of variance (Anova), with a reliability ($p \leq 0.01$).

Variable evaluated

Number of shoots: Green shoots developed four weeks after the last application were counted.

Agronomic management

The crop was irrigated and fertilised daily via fertigation with a Steiner solution at 2.5 dS/m, managed at 25 % in the first month, 50 % in the second month and from the third month onwards at 100 %. For ant control, a biological control based on Beauveria bassiana was chosen first, followed by a chemical control based on imidacloprid. Weekly applications of garlic extract as a pest repellent were also carried out, as well as the establishment of trap crops on the periphery of the macro tunnel.

Results and discussion

The analysis of variance did not show statistically significant differences between the foliar fertilizer treatments for the variable number of green shoots, as shown in table 1; both with a $p = 0.05$ and $p = 0.01$.

					F_{tab}	
FV	**GL**	**SC**	**CM**	**F_{cal}**	**5%**	**CM**
Trat	4	18.2	4.55	0.54	3.05^{NS}	4.55
Error	15	126.38888	8.4259			8.4259
Total	19	144.58888				

FV: Source of Variation; T: Treatment; GL: degrees of freedom; SC: sum of squares; MC: mean square; Fcal: calculated F-value; Ftab: F-value from tables; NS: not significant.

Table 1 Analysis of variance and statistical significance for number of green shoots in blueberry cv. Ventura under macro-tunnel in response to foliar fertilizer application in Valle de Santiago, Gto.

Although no statistical differences were found between treatments, the plants responded excellently to the development of green shoots in the vegetative stage V3 and V4 (Rivadeneira, 2007); they developed between 13 and 16 shoots in a period of three months, being vigorous, of a normal green colour and with considerable length to avoid problems of elongation and stress due to high temperatures and lack of water in the substrate (Undurraga, 2013), as shown in Figure 1.

ISSN 2414-4932

Figure 1 Green shoots in vegetative stage V4 in blueberry cv. Ventura under macro-tunnel in Valle de Santiago, Gto.

The optimal characteristics of the green shoots and, above all, the balance between aerial and root organs, were also maintained thanks to the nutrition provided in a timely manner via fertigation; despite the fact that the EC levels in the substrate were higher than those required by the crop in the vegetative stage; however, foliar fertilisation as a complement to fertigation was very important and key to the development of the green shoots.

However, these conditions of the shoots, in addition to the climate and nature of the experimental space, caused the presence and damage by defoliating insects such as the army ant (Atta sp.) mainly; for which, appropriate control measures had to be applied with chemical systemic insecticides and entomopathogenic fungi.

Conclusions

Despite the development of green shoots between 13 and 16 shoots per plant, all the foliar fertilisers produced statistically the same number of shoots three months after the first weekly application.

Adaptation of the blueberry crop under macro-tunnel was achieved under these production, microclimate and agronomic management conditions; however, it is necessary to improve some management aspects such as nutrition and, above all, to provide optimal protected conditions for the crop.

References

Caicedo. 2020. Adaptabilidad en el sistema de producción agrícola: Una mirada desde los productos alternativos sostenibles. Revista de Ciencias Sociales, 16 (4):308-327.

Casas V. 2017. Establecimiento preliminar de las condiciones agroclimáticas, zonas de adaptación y cultivares potenciales para el desarrollo del cultivo del arándano (*Vaccinium corymbosum*) en Colombia. Tesis de Ingeniera Agronómica. Universidad de Cundinamarca. Fusagasugá, Colombia. 53 p.

García. 2018. El cultivo del arándano en el norte de España. SERIDA. Madrid, España. 188 p.

Gordo, M. 2008. Guía práctica para el cultivo de arándanos en la zona norte de la provincia de Buenos Aires. Ed. INTA, EEA San Pedro Bs As. 15 p.

Gough, R. 1994. The highbush blueberry and its management. 1ra edition. Haworth Press, Inc. Nueva York, Estados Unidos. 271 pp.

INIA. 2017. Manual de manejo agronómico del arándano. INDAP-Ministerio de Agricultura. Santiago, Chile. 97 p.

Intagri. 2017. El Cultivo de Arándano. Serie Frutillas. Núm. 17. Artículos Técnicos de INTAGRI. México. 10 p.

Morales. 2017. Manual de manejo agronómico del arándano. Ed. INIA. Santiago, Chile. 96 p.

Rivadeneira M. (s.f.). Etapas fenológicas en arándano durante las campañas 2006-2007. Ed. Instituto Nacional de Tecnología Agropecuaria. Entre Ríos, Argentina. 6 p.

Rodríguez. 2019. Blueberry IPM: Past Successes and Future Challenges. Annu Rev Entomol. 7(64):95-114. DOI: 10.1146/annurev-ento-011118- 112147. PMID: 30629894.

SAGARPA. 2017. Frutas del bosque: arándano, frambuesa, zarzamora. Ed. SAGARPA. Ciudad de México, México. 22 p.

ISSN 2414-4932

Undurraga. 2013. Manual del arándano. Ed. INIA. Chillán, Chile. https://hdl.handle.net/20.500.14001/7627 (Consultado en marzo de 2022).

Acknowledgements

To Cravo Equipment LTD, for the donation of blueberry plants to the Sustainable and Protected Agriculture course.

ISSN 2414-4932