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REMEXCA

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Article

Pruning management in blueberries and its effect on *Lasiodiplodia* spp.

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Abstract

Blueberries (*Vaccinium* spp.) are a fruit with recognized medicinal properties and rich in antioxidants, vitamins, and fiber, which has boosted their global demand. Nonetheless, the crop faces certain challenges, such as ‘dieback’ by the fungus *Lasiodiplodia* spp., which can severely reduce production. To mitigate this disease, regular pruning is essential, improving air circulation and sunlight penetration, creating a less favorable environment for fungi. The objective of this research was to determine the effects of pruning management on the incidence of *Lasiodiplodia* spp. in crops of blueberries (*Vaccinium corymbosum* L.) var. Biloxi. The study was conducted in Piura, Peru, in 2022; different pruning treatments were evaluated in plants affected by *Lasiodiplodia* spp., using a CRD with five treatments and a control, with a sample size of two hundred plants; likewise, Duncan’s test was used to compare the effects. The results showed that more aggressive pruning, which removed more leaves and sap drawers, resulted in increased shoot growth due to the plants’ ability to regenerate in the face of severe stress, thereby stimulating greater production of growth hormones, such as cytokinins. Additionally, plants with aggressive pruning exhibited a higher incidence of *Lasiodiplodia* spp., suggesting that treatments T1 and T0 were the most balanced options. It was concluded that a combination of pruning techniques is essential to maintain the health of blueberry crops against the attack of *Lasiodiplodia* spp.

Palabras clave:

Vaccinium corymbosum, canker, cultural control.

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Introduction

Blueberries are small, round, dark blue fruits belonging to the genus *Vaccinium*, recognized for their exceptional medicinal properties; they are also rich in antioxidants, especially anthocyanins, which contribute to the prevention of cardiovascular diseases and the strengthening of the immune system (Ávila-Román *et al*., 2021). Additionally, their high vitamin C and fiber contents make them an ideal food for improving digestion and eye health (Gutiérrez-Rodas, 2022). Thanks to these nutritional benefits, the growing demand for blueberries is due to their reputation as a superfood, which has boosted their global consumption among people seeking a healthy and preventative diet (Tinoco-Plasencia *et al*., 2023).

Since 2020, blueberry production has grown considerably, generating higher incomes for growers thanks to the expansion of international markets, especially in China, the United States of America, and Europe. Improved agricultural techniques and the adoption of new technologies have increased crop efficiency and quality, making blueberries a profitable investment option (INEI, 2023). In relation to the management of blueberry crops, it is characterized by requiring specific conditions associated with soil and climate aspects. In this sense, the crop requires soils with an acidic pH that should range between 4.5 and 5.5, in addition to good aeration and a soil structure that allows optimal drainage to avoid root problems (Meléndez-Jácome, 2021).

The climatic aspect also plays a key role in blueberry crops. It has been shown that this plant species tolerates temperatures between 7 and 33 °C; however, for optimal growth, ranges of 16 to 25 °C are required; therefore, it is vital that the crop be established in areas that allow these parameters to be maintained (Ormazábal *et al*., 2020). In Peru, blueberry crops in Piura face stress from high temperatures and radiation, factors reported across various regions of the country, reaching critical levels of UV-B radiation at certain times of the year (SNMHP, 2024). These conditions make the crop more vulnerable to fungal diseases, among which the most serious is caused by *Lasiodiplodia* spp., leading to dieback and stem canker (Polanco-Florián *et al*., 2020).

In addition to the above, improper pruning can contribute to the development of dieback. Thus, some studies establish that pruning, if carried out without considering the physiological condition of the plant or without adequate disinfection, significantly increases the incidence; although techniques such as health pruning, application of *Trichoderma*, fungicides, and management of irrigation and salts have been used, failures in control persist, which shows a gap in knowledge about the specific effect of the levels and types of pruning on the progression of the disease (Rodríguez-Gálvez *et al*., 2020; Aguilar-Anccota *et al*., 2024).

On the other hand, dieback can cause significant yield losses, severely affecting production in severe cases. Infected plants show symptoms such as necrosis of branches and fruits, which decreases both the quality and quantity of the final product, thus generating considerable economic losses for farmers; this is because, when the vegetative zone of the plant is affected, its ability to generate photosynthates, which are important for proper fruiting, decreases (Flores Hernández *et al*., 2021).

Based on the above, a key agronomic practice for mitigating the effects of *Lasiodiplodia* spp. on crops is regular and adequate pruning. Pruning helps to improve air circulation and sunlight penetration into the plant canopy, reducing humidity and creating a less favorable environment for fungal development. In addition, removing infected branches and fruits can limit the spread of the disease within the crop (Polanco-Florián *et al*., 2020; Morales-Pizarro *et al*., 2023). Likewise, it is also essential to carry out pruning properly. If this practice is carried out at inappropriate times, such as periods of water stress or extreme temperatures, or with unsuitable tools, it can generate wounds in plant organs that can facilitate the entry of pathogens, increasing the risk of infection. This situation weakens the plant and can even lead to death (Sallesses *et al*., 2023; Maticorena-Quispe and Escobedo-Álvarez, 2024).

In light of the above statement, the following question arises: how does the type of pruning influence the control of *Lasiodiplodia* spp. in blueberry crops? Therefore, this research aimed to determine the effects of pruning management on the incidence of Lasiodiplodia spp. in crops of blueberries (Vaccinium corymbosum L.) var. Biloxi.

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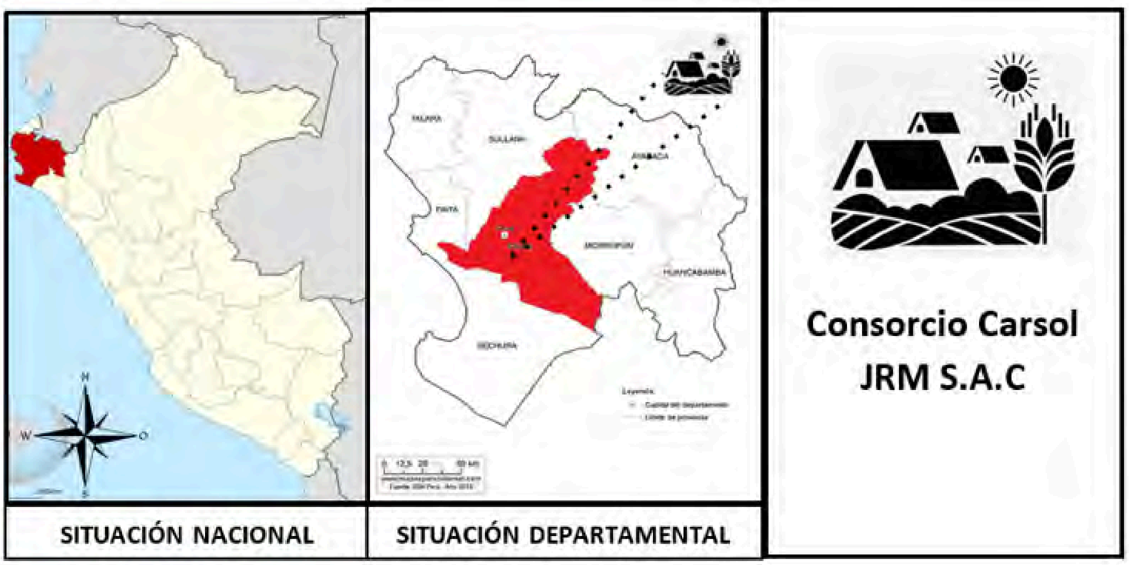
Materials and methods

The research adopted a quantitative methodological approach, with an experimental design aimed at describing and analyzing the effects of the treatments applied.

Location of the study area

The study was conducted on the farm of Consorcio Carsol JRM SAC, located in the province and department of Piura, Peru, in an area engaged in blueberry cultivation, and the coordinates of which are latitude: -12.166111 and longitude: -77.003333 (Figure 1). The sample size for the research was 200 plants.

Figure 1. Geographical location. Adapted from Google.



According to what was reported by the National Meteorology and Hydrology Service of Peru (2020), the temperature in Piura has the highest levels in February and March (34.1 °C), the lowest temperature occurs in July, August and September (17.1 °C), and precipitation shows the greatest intensity in March (65.5 mm month^{-1}) (Figure 2).

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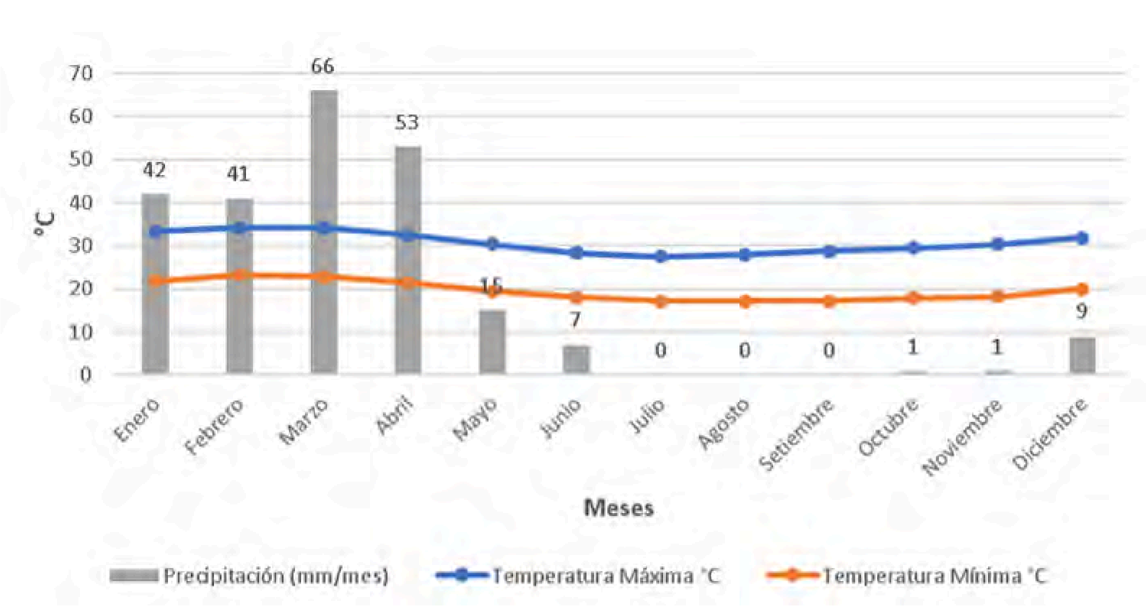
Figure 2. Climatic characteristics of Piura. Adapted from SENAMHI.



Materials

For the research, we used three-year-old adult plants of blueberry (*Vaccinium corymbosum* L.) var. Biloxi, established in the field and affected by *Lasiodiplodia* spp., which was identified by performing a morphological diagnosis and laboratory isolation of the affected part. The analyses confirmed the presence of the genus *Lasiodiplodia*, with *Lasiodiplodia theobromae* predominating, a species already reported as the most common in blueberry crops affected by this disease in various regions of Peru (Rodríguez-Gálvez *et al*., 2020).

The pruning was carried out in October 2021, and the study was conducted in the weeks that followed. Likewise, treatments were established, which were differentiated according to the type of pruning performed, which is a cultural task within the good agricultural practices, stipulated in the Peruvian Technical Standards (2021), and that was adapted to the conditions of the crop evaluated. The treatments in question are detailed below (Table 1).

Table 1. Description of the treatments by the type of pruning carried out.

Treatment	Description
T0	Conventional pruning carried out on the plant, where the leaves and more than two sap drawers are left
T1	Pruning that leaves the plant 40 cm tall, with leaves and two sap drawers
T2	Pruning that leaves the plant 40 cm tall, with leaves and no sap drawers
T3	Pruning that leaves the plant 40 cm tall, without leaves, and with two sap drawers
T4	Conventional pruning carried out on the plant, but without the leaves and without sap drawers
T5	Pruning that leaves the plant 40 cm tall, without leaves, without sap drawers, and with cleaning of small branches

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According to the table above, it is necessary to specify that conventional pruning involves the removal of unwanted branches or shoots (twigs) from the base of the plant. On the other hand, sap drawers are twigs left near the cut to aid healing (Redagrícola, 2020; Maticorena-Quispe and Escobedo-Álvarez, 2024).

Methods

The parameters evaluated in the research are described below, which were based on the methodology established by the National Agrarian Health Service (2019).

Incidence

The percentage of plants affected by the disease per treatment was evaluated five weeks after pruning using the following equation.

1)

$$\text{Incidence }\% = \frac{\text{Number of diseased plants}}{\text{total number of plants}} x100$$

Variation in shoot length

At the end of the fourth week, a cleaning pruning was carried out on all the plants of each treatment and control (T0). After three weeks, the growth of the shoots in centimeters was evaluated, which allowed us to detect the physiological effect of pruning strategies on the regrowth capacity of the crop and its indirect relationship with the incidence of *Lasiodiplodia* spp., given the latter's preference for weakened or damaged tissues.

Statistical analysis

To evaluate the incidence and variation in shoot length, a completely randomized design (CRD) was applied, with five treatments and one control. Then, Duncan's test was applied to compare the effects; all at a significance level of 0.05. The programs used for data processing were IBM SPSS Statistics version 26 and Microsoft Excel Professional Plus 2019.

Results

Incidence

The results of the statistical processing for the incidence of *Lasiodiplodia* spp. in blueberry are shown below (Figure 3).

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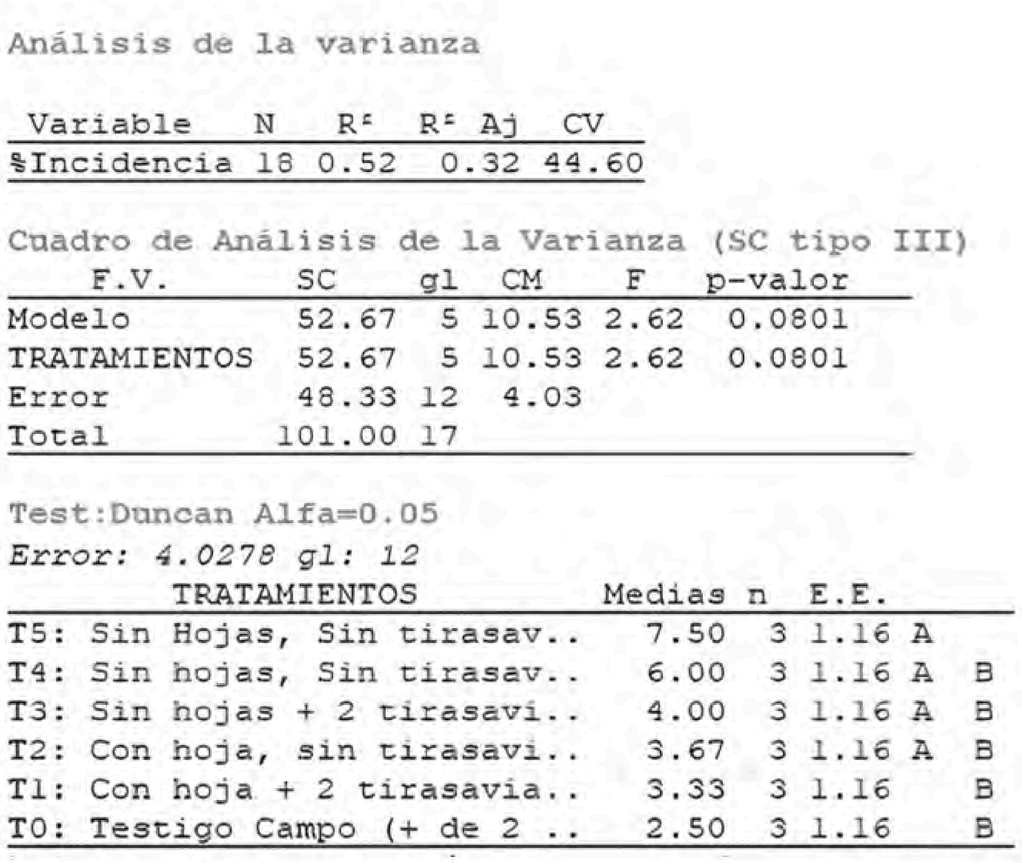
Figure 3. Statistical analysis of incidence in treatments. Means with different letters indicate significant differences at p > 0.05.



Análisis de la varianza

Variable	N	R²	R² Aj	CV
%Incidencia	18	0.52	0.32	44.60

Cuadro de Análisis de la Varianza (SC tipo III)

F.V.	SC	gl	CM	F	p-valor
Modelo	52.67	5	10.53	2.62	0.0801
TRATAMIENTOS	52.67	5	10.53	2.62	0.0801
Error	48.33	12	4.03		
Total	101.00	17			

Test:Duncan Alfa=0.05

Error: 4.0278 gl: 12

TRATAMIENTOS	Medias	n	E.E.		
T5: Sin Hojas, Sin tirasav..	7.50	3	1.16	A	
T4: Sin hojas, Sin tirasav..	6.00	3	1.16	A	B
T3: Sin hojas + 2 tirasavi..	4.00	3	1.16	A	B
T2: Con hoja, sin tirasavi..	3.67	3	1.16	A	B
T1: Con hoja + 2 tirasavia..	3.33	3	1.16		B
T0: Testigo Campo (+ de 2 ..	2.50	3	1.16		B

According to Figure 3, significant differences were observed between treatment T5 and treatments T1 and T0; nevertheless, no statistically significant differences were observed between the other treatments. Treatment T5, characterized by a more drastic pruning (40 cm plant size, no leaves, no sap drawers and with cleaning of small branches), presented the highest incidence of *Lasiodiplodia* spp. In contrast, treatments T0 and T1, which preserved leaves and two or more sap drawers, had the lowest incidence of the disease.

Variation in shoot length

Regarding this parameter, the results are shown according to the statistical processing carried out (Figure 4).

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Figure 4. Statistical analyses for variation in shoot length according to treatments. Means with different letters indicate significant differences at p > 0.05.

Análisis de la varianza

Variable	N	R²	R² Aj	CV
Longitud (cm)	299	0.05	0.03	29.26

Cuadro de Análisis de la Varianza (SC tipo III)

F.V.	SC	gl	CM	F	p-valor
Modelo	1260.52	5	252.10	3.11	0.0095
TRATAMIENTOS	1260.52	5	252.10	3.11	0.0095
Error	23780.30	293	81.16		
Total	25040.82	298			

Test:Duncan Alfa=0.05

Error: 81.1614 gl: 293

TRATAMIENTOS	Medias	n	E.E.			
T2: Con hoja, sin tirasavi..	33.41	50	1.27	A		
T4: Sin hojas, Sin tirasav..	32.73	50	1.27	A		
T3: Sin hojas + 2 tirasavi..	31.75	50	1.27	A	B	
T5: Sin Hojas, Sin tirasav..	30.44	50	1.27	A	B	C
T1: Con hoja + 2 tirasavia..	28.51	50	1.27		B	C
T0: Testigo Campo (+ de 2 ..	27.87	49	1.29			C

Medias con una letra común no son significativamente diferentes (p > 0.05)

According to Figure 4, treatments T2 and T4 presented greater elongations with significant differences compared to treatments T1 and T0. However, no significant differences were observed with treatments T3 and T5. Likewise, treatment T0 presented no statistically significant differences compared to treatments T5 and T1, suggesting that less aggressive pruning does not significantly stimulate shoot elongation.

Discussion

Due to the results presented in the previous section, treatments T0 and T1, which preserved leaves and sap drawers, obtained a form of physical barrier that could reduce the penetration and colonization of *Lasiodiplodia* spp., in the cut or exposed tissues of the plant, considering that the dispersal of the phytopathogen is through the spores contained in the pycnidia, which are transported by the wind (Moreira-Morrillo *et al*., 2021). On the other hand, leaving leaves and sap drawers can stimulate a defensive response. Pruning wounds can activate local and systemic defense mechanisms in the plant when biomass, such as leaves and stems, is preserved, which promotes a better physiological response to the pathogen since it can encourage the production of phenolic compounds, phytohormones, and defense proteins that limit or prevent colonization of the pathogen (Camacho-Escobar *et al*., 2020).

In treatments without leaves or sap drawers, pruning wounds were more exposed to desiccation and adverse environmental conditions (Camacho-Tapia *et al*., 2021). The desiccation of the cut tissues can weaken the plant's ability to form effective physical and chemical barriers against pathogen invasion (Delgado-Oramas, 2020). The stress caused by severe pruning in plant species can also favor the incidence of *Lasiodiplodia* spp.; at this point, the plant becomes susceptible to attack by the pathogen, as occurs in other crops such as Persian lime (Citrus latifolia Tan.) (Leyva-Mir et al., 2021).

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Aggressive pruning also encourages the growth of new shoots, as the plant directs photosynthates to areas that require them, which can be called photosynthetic efficiency (Orozco-Orozco *et al*., 2022). The appearance of tender shoots can favor the infestation of *Lasiodiplodia* spp., as observed in cocoa studies, where the pathogen, already established in the plant, affects young twigs (Moreira-Morrillo *et al*., 2021). Another problem that can affect blueberry crops is precisely poorly performed pruning, as evidenced in this study, where the treatments with the highest incidence were those that were totally or partially devoid of plant material. This is because the plant loses photosynthetic structures to generate energy and counteract the effects of the pathogen (Rascón-Solano *et al*., 2020).

Regarding shoot development, greater length growth was obtained in the treatments with more aggressive pruning, which is consistent with the plants' ability to regenerate due to severe stress (Valverde-Otárola and Arias, 2020). On the contrary, those plants that retained leaves and sap drawers showed more balanced growth, whereas those subjected to aggressive pruning redirected their resources towards new shoots in response to stress (Valenzuela-Erazo, 2020; Deloire *et al*., 2022). This effect is due to an increase in cytokinins, hormones that stimulate shooting and promote the development of vegetative shoots under favorable conditions (Carnelos *et al*., 2022).

Conclusions

Treatments that preserved leaves and sap drawers had a lower incidence, suggesting that these organs act as a physical barrier that limits the penetration of spores of the pathogen *Lasiodiplodia* spp. into exposed tissues, with treatments T0 and T1 having the best results. In addition, the preservation of these active plant organs seems to promote a physiological defense response by activating mechanisms such as the production of phenolic compounds and hormones, which strengthen the plant's resistance.

In contrast, severe pruning, characterized by the total elimination of leaves and sap drawers, increased the incidence of the pathogen, possibly due to greater exposure of wounds and lower initial defense ability. Nonetheless, these prunings induce more vigorous shoot growth as a compensatory response to stress, which was reflected in higher elongation rates, due to the redirection of resources and the production of growth hormones.

Finally, it was observed that the partial conservation of vegetative organs led to a more balanced growth by maintaining photosynthetic activity and distributing resources more evenly. These findings suggested that moderate pruning, which retains part of the biomass, may be more efficient in terms of plant health and development.

Bibliography

1 Aguilar-Anccota, R.; Imán-Castillo, M. Á.; Silupú-Masías, J. A.; Rafael-Rutte, R.; Calle-Cheje, Y. H.; Campos-Silva, I. A. and Javier-Alva, J. 2024. Prospecting and management alternatives of fungal diseases associated in the blueberry crop (*Vaccinium corymbosum* L.). Agroindustrial Science. 13(3):163-171. https://doi.org/10.17268/agroind.sci.2023.03.07.

2 Alcántara-Cortes, J. S.; Acero-Godoy J.; Alcántara-Cortés, J. D. y Sánchez-Mora, R. M. 2019. Principales reguladores hormonales y sus interacciones en el crecimiento vegetal. Nova. 17(32):109-129. https://doi.org/10.22490/24629448.3639.

3 Ávila-Román, J.; Soliz-Rueda, J. R.; Bravo, F.; Aragonès, G.; Suárez, M.; Arola-Arnal, A.; Mulero, M.; Salvadó, M.; Arola, L.; Torres-Fuentes, B. and Muguerza, B. 2021. Phenolic compounds and biological rhythms: who takes the lead? Trends Food Sci Technol. 113:77-85. https://doi.org/10.1016/j.tifs.2021.04.050.

DOI: https://doi.org/10.29312/remexca.v17i1.3880

4 Camacho-Escobar, M. A.; Ramos-Ramos, D. A.; Ávila-Serrano, N. Y.; Sánchez-Bernal, E. y López-Garrido, J. 2020. Las defensas fisicoquímicas de las plantas y su efecto en la alimentación de los rumiantes. Revista Terra Latinoamericana. 38(2):443-453. https://doi.org/10.28940/terra.v38i2.629.

5 Camacho-Tapia, M.; Leyva-Mir, S. G.; Bautista-Cruz, M. A.; Almaguer Vargas, G.; Colinas León, M. y Tovar Pedraza, J. 2021. Efectividad de fungicidas y *Trichorderma* spp. para el control de *Lasiodiplodia* spp. en huertos de limón 'Persa' en Veracruz. Revista Mexicana de Ciencias Agrícolas. 12(2):345-53. https://doi.org/10.29312/remexca.v12i2.2551.

6 Carnelos, C.; Lozano-Miglioli, J.; Giardina, E.; Tognetti, J. y di Benedetto, A. 2022. Reanálisis de la acción de la citoquinina: los cambios anatómicos de la hoja juegan un papel clave en la promoción del crecimiento impulsada por la 6-bencilaminopurina en lechuga cultivada en maceta. Revista Chapingo. Serie Horticultura. 28(2):109-132. https://doi.org/10.5154/r.rchsh.2021.07.015.

7 Delgado-Oramas, B. 2020. La resistencia inducida como alternativa para el manejo de plagas en las plantas de cultivo. Revista de Protección Vegetal. 35(1):1-12. http://scielo.sld.cu/pdf/rpv/v35n1/2224-4697-rpv-35-01-e07.pdf.

8 Deloire, A.; Dumont, C.; Giudici, M.; Rogiers, S. y Pellegrino, A. 2022. Unas cuantas palabras sobre las yemas de invierno y la poda de respeto del flujo de savia. IVES Technical Reviews. https://doi.org/10.20870/ives-tr.2022.5512.

9 Flores-Hernández, H.; Flores-Gracia, J.; Varela-Fuentes, S. E.; Pérez-Rodrígue, A.; Azuara-Domínguez, A. y Monteon-Ojeda, A. 2021. Reporte de *Lasiodiplodia theobromae* (Pat.) Griffon y Maubl. en árboles cítricos de Tamaulipas. Revista Mexicana de Ciencias Agrícolas. 12(3):499-511. https://doi.org/10.29312/remexca.v12i3.2640.

10 Gutiérrez-Rodas, R. 2022. Efecto de la actividad antioxidante en una conserva de arándanos. Polo del conocimiento. 7(11):1243-1263. https://dialnet.unirioja.es/descarga/articulo/9263578.pdf.

11 INEI. 2023. Instituto Nacional de Estadística e Informática. Producción de arándano. https://www.inei.gob.pe.

12 Leyva-Mir, S. G.; Bautista-Cruz, M. A.; Almaguer-Vargas, G.; Colinas-León, M. T.; Tovar-Pedraza, J. M. y Camacho-Tapia, M. 2021. Efectividad de fungicidas y *Trichorderma* spp. para el control de *Lasiodiplodia* spp. en huertos de limón 'Persa' en Veracruz. Revista Mexicana de Ciencias Agrícolas 12(2):345-353. https://www.scielo.org.mx/pdf/remexca/v12n2/2007-0934-remexca-12-02-345.pdf.

13 Maticorena-Quispe, M. F. y Escobedo-Álvarez, J. A. 2024. Cinco tipos de poda en arándano (*Vaccinium corymbosum* L. cv. Biloxi) y su influencia en determinados parámetros productivos. Ciencia latina. Revista Científica Multidisciplinar. 8(3):3212-3228. https://doi.org/10.37811/cl-rcm.v8i3.11543.

14 Meléndez-Jácome, M. R.; Flor-Romero, L. E.; Sandoval-Pacheco, M. E.; Vasquez-Castillo, W. A. y Racines-Oliva; M. A. 2021. *Vaccinium* spp.: características cariotípicas y filogenéticas, composición nutricional, condiciones edafoclimáticas, factores bióticos y microorganismos benéficos en la rizosfera. Scientia Agropecuaria. 12(1):109-120. https://www.scielo.org.mx/scielo.php?script=sci-arttext&pid=S2007-09342019001000175.

15 Morales-Pizarro, A.; Neira-Rojas, I.; Saavedra-Alberca, E., Zapatel-Sime, K.; Álvarez, L.; Peña-Castillo, R.; Aguilar-Anccota, R.; Galecio-Julca, J. y Javier-Alva, J. 2023. Alternativas sostenibles para el control de *Lasiodiplodia theobromae* (Pat.) Griffon & Maubl en mango. Tropical and Subtropical Agroecosystems. 27(1):1-8. https://doi.org/10.56369/tsaes.4839.

16 Moreira-Morrillo, A. A.; Cedeño-Moreira, Á. V.; Canchignia-Martínez, F. y Garcés-Fiallos, F. R. 2021. *Lasiodiplodia theobromae* (Pat.) Griffon & Maul [(Sin.) *Botryodiplodia theobromae* Pat.] en el cultivo de cacao: síntomas, ciclo biológico y estrategias de manejo. Scientia Agropecuaria. 12(4):653-662. https://doi.org/10.17268/sci.agropecu.2021.068.

DOI: https://doi.org/10.29312/remexca.v17i1.3880

17 Normas Técnicas Peruanas. 2021. Arándano. Buenas prácticas agrícolas. INACAL.

18 Ormazábal, Y. M.; Mena, C. A.; Cantillana, J. C. y Lobos, G. E. 2020. Caracterización de predios productores de arándanos (*Vaccinium corymbosum*), según nivel tecnológico. El caso de la región del maule chile. Información Tecnológica. 31(1):41-52. http://dx.doi.org/10.4067/S0718-07642020000100041.

19 Orozco-Orozco, L. F. y Lozano-Fernández, J. 2022. Efecto de las podas sobre el rendimiento de *Capsicum annum* L. bajo dos ambientes. Agronomía Mesoamericana. 33(1):1-19. https://www.redalyc.org/journal/437/43768481005/43768481005.pdf.

20 Polanco-Florián, L. G.; Alvarado-Gómez, O. G.; Olivares-Sáenz, E.; González-Garza, R. y Pérez-González, O. 2020. Control biológico de *Lasiodiplodia theobromae* y *Fomitopsis meliae* causantes de la muerte regresiva de los cítricos. Revista Mexicana de Ciencias Agrícolas. 11(5):1069-1081. https://doi.org/10.29312/remexca.v11i5.2272.

21 Hidrología del Perú. 2020. Servicio Nacional de Meteorología e Hidrología del Perú. Pronóstico del tiempo. Ministerio del ambiente. https://www.senamhi.gob.pe/?p=pronostico-detalle&dp=20&localidad=0003.

22 Rascón-Solano, J.; Galván-Moreno, V.; García-García, S. y Hernández-Salas, J. 2021. Manual práctico para podas. Universidad Autónoma de Chihuahua (UACH). 16-20 pp. https://www.researchgate.net/publication/360383891-Manual-Practico-para-Podas.

23 Redagrícola. 2020. Experto recomienda estrategias para el control de este y otros patógenos. https://redagricola.com/andres-france-lasiodiplodia-principal-problema-arandano/.

24 Rodríguez-Gálvez, E.; Hilário, S.; Lopes, A. and Alves, A. 2020. Diversity and pathogenicity of *Lasiodiplodia* and *Neopestalotiopsis* species associated with stem blight and dieback of blueberry plants in Peru. European Journal of Plant Pathology. 157(1):89-102. https://doi.org/10.1007/s10658-020-01983-1.

25 Sallesses, L.; Moreno, K.; Delgado, V.; Quiñones, A.; Fernández, M. y Gyenge, J. 2023. La poda del arbolado urbano: repensando una práctica contraproducente. Visión Rural. 147:48-50. https://www.researchgate.net/publication/374199231-La-poda-del-arbolado-urbano-repensando-una-practica-contraproducente.

26 SNMHP. 2024. Servicio Nacional de Meteorología e Hidrología del Perú. Boletín mensual vigilancia de la radiación UV-B en ciudades del país. Ministerio del ambiente. https://repositorio.senamhi.gob.pe/handle/20.500.12542/3145.

27 SNSA. 2019. Servicio Nacional de Sanidad Agraria. 2019. Metodología de evaluación de plagas agrícolas. Dirección de Sanidad Vegetal del Perú.

28 Tinoco-Plasencia, C. J.; Zambrano-Casimiro, L. M.; Roque-Paredes, O.; Chávez-Mayta, R. W.; Maguiña-Vásquez, B. M. y Espejo Calderón, J. W. 2023. Los arándanos, generalidades y desarrollo en el mercado mundial: una revisión de literatura. Paideia. 13(1):125-140. https://doi.org/10.31381/paideia.v13i1.5674.

29 Valenzuela-Erazo, D. A. 2020. Efecto de la altura de poda en la producción de brotes o rametos ortotrópicos en condiciones de vivero. Revista de Investigación Talentos. 7(1):81-89. https://dialnet.unirioja.es/descarga/articulo/8551259.pdf.

30 Valverde-Otárola, J. y Arias, G. 2020. Efectos del estrés hídrico en crecimiento y desarrollo fisiológico de *Gliricidia sepium* (Jacq.) Kunth ex Walp. Colombia forestal. 23(1):20-34. http://www.scielo.org.co/scielo.php?script=sci-arttext&pid=S0120-07392020000100020.

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