PRINTED ISSN: 2305-8552
ELECTRONIC ISSN: 2414-8695
UCV HACER
Journal of Research and Culture, César Vallejo University, Chiclayo
UCV HACER J. Res. Cult. Volume 5, N° 1, January – June 2016
Chiclayo, Lambayeque - Perú

Productos biológicos y químicos para el control de pudrición gris y acida en el cultivo de vid (vitis vinífera l.) en condiciones de campo, Chongoyape 2015

Biological and chemical products for the gray mold and acid rot control in growing of vines (*vitis vinifera l.*) under field conditions, Chongoyape 2015

RIVERA PUELLES, Thalía Puelles[1]; CAJÁN ALCÁNTARA, John William[2]

Resumen

La presente investigación tuvo como objetivo determinar que los productos biológicos y químicos permiten controlar la pudrición gris y la pudrición ácida del cultivo de vid *(vitis vinífera l.)* en condiciones de campo, llevada a cabo en el distrito de Chongoyape, 2015. Se utilizó el diseño de bloques completos al azar con 5 tratamientos y cuatro repeticiones con 60 racimos por tratamiento. Los resultados obtenidos mostraron que no existió presencia de *Botritis cinérea* agente causal de "Pudrición Gris" tanto en los análisis de laboratorio como en campo, pero si se encontró al complejo de microorganismos causantes de la "Pudrición Ácida" entre los que destacan las bacterias *Acetobacter spp*, levaduras como *Kloeckera spp* y hongos como *Aspergillus niger*.

Palabras claves: Productos biológicos. Productos Químicos. Control de Pudrición gris y ácida. Cultivo de vid.

Abstract

The aim of the present research was to determine that the biological and chemical products allow control the gray mold and acid rot in growing of the vine (vitis vinífera l.) Under field conditions, carried out in Chongoyape district, 2015. The randomized complete block design was used with 5 treatments and four repetitions with 60 clusters per treatment. The results obtained showed that there was no presence of Botrytes cinerea, the causal agent of "Gray Mold" in the laboratory as well as in the field .However if it was found the complex of microorganisms which cause the "Acid Mold" among which stand out the bacterium Acetobacter spp, yeast like Kloeckera spp and fungi like Aspergillus niger.

Key words: Organic products. Chemical products. Gray mold and acid rot control. Growing of vine.

Received: May 25, 2016
Accepted: June 20, 2016
Published: August 2016

1 Bachelor Degree in Agricultural Engineering, rive_1993_15@hotmail.com
2 Doctor in Education, Professor in the school of Agricultural Engineering. César Vallejo University. Chiclayo, johncajan@hotmail.com

Introduction

For a long time the growing of vine has become in a agricultural activity developed in several countries in the world, like European countries who are the traditional producers and exporters of this product. Italy ranks the first place in export, however in the last years other countries have been added to the list as Chile,Peru,United States becoming in world export of this fruit (Freire, 2002)

Grape Plantations in Peru have been developed so that they can cover the demand in Asia; the exporters have focused all efforts on satisfying it and achieve to stand out among other providers more traditional ones like Chile and South Africa. The opening of South Korea and negotiations to open the Japanese market, they constitute alternatives to the Peruvian grape, which until now has been concentrated in China. There, the volumes have significantly increased every year, reaching around 60 thousand tons in 2013/14 season, if we compare the 85 thousand tons of Chilean offer, do not leave us so far from the great grape exporter in the world (Department of Agriculture 2015).

In consequence, the installed area currently in Peru is about 11,000 hectares with an increase of 47% in the last 5 years, due mainly to the new plantations in Piura and Lambayeque whose area adds up 4,085 hectares. Lima, Ica and Arequipa they have also experienced an increase in the grape area sown above all Ica and Arequipa with 21% and 63% respectively. ([1]prom Peru 2013).

As the area sown increases to satisfice the foreign demand also fitosanitary problems increase as the "Grey mold" disease , which is caused by *Botrytis cinerea* and the "Acid Rot", which is caused by a pathogens complex such as fungi, bacteria and yeasts.

1 Prom Perú: Promotion of Peru for the Export and the Tourism

In Lambayeque, these diseases are being presented with higher incidence and severity each campaign, decreasing significantly production and quality of their crops. The effective control of the diseases implies the approach of a strategy integrated managing of plagues that involves the cultural , biological and chemical components in an effective way without creating toxic residues, which nowadays it hasn't given a good result due the mechanism of the diseases is very complex associated with extrinsic and intrinsic factors. ([2] INIA, 2013)

For a better precision of the problem of vine growing in San Juan Company, located in chongoyape, district of Chiclayo, province of Lambayeque department, a survey was applied to those responsible of each area in the management agronomic in the growing of vine. The results allowed determining that the main problem that affects the production and quality of grape is the presence of the gray mold and acid rot.

The identification of this problem is based on a question: In what measured, the biological and chemical products allow control of gray mold and acid rot in growing of vine (viti vinifera.L.) under field conditions, Chongoyape 2015? Wish is why, the general objective was raised: To determine that the products biological and chemical substances allow to control "Gray Mold" and the "acid rot" of the Growing of vine (vitis vinifera L.) under field conditions, Chongoyape, 2015

Checking some antecedents of variables´s study as Mateluna (2006) was found in his *thesis: Study of antibacterial activity of potentials biocontrol on acetic bacteria involved in the acid rot of the grape made in Chile; concluded,* "The results obtained were 14 strains found which showed certain antigonical characteristic in front of the acetic

2 INIA : *National Institute of Agrarian Innovation*

Bacterias. There was no demonstration some of inhibitory activity in the supernatant that was without cells of the biocontrol ". Barriga (2009), in his thesis: "Evaluation of the field effectiveness of a chlorinated product in fungal control associated with acid rot in vine cv.cabernet Sauvignon "made at the University of Talca Chile. He concluded: "The disease known as acid rot of the vine corresponds to a complex of microorganisms pathogens, among which mushrooms stand out, yeasts and acetic bacteria ".

(Barriga, 2009, pp.37). Meza (1996), in his thesis "Detection of initial states of Botrytis cinerea Pers in fences of *Vitis vinifera* L. cv. Thompson seedless by immune essays "conducted at the University of Chile. The results indicate that the direct method presents higher sensibility of detection, with respect to the inhibition modality. It was observed clear absorbance differences according to the inoculum concentration used, checking statistically significant among the states of development of the pathogen in macerated fruit without skin. Regarding the theoretical framework, the grape is an angiosperm, of the dicotyledonous class; it has simple flowers (choripetalae). It corresponds to the order Rhamnales, characterized by being long-lived woody plants. The yolks formed during a cycle are responsible of the production. (Salazar, and Melgarejo, 2005).

Memenza (2008), mentions that the vine is a Plant able to adapt to places with different climates, to prosper needs summers long with warm to hot temperatures and cool winters. The growing of vines in Peru has constituted as one of the activities agricultural of greater economic importance, representing the second export fruit with a total income of $ 48.6 million. Being United States the main destination market followed by the Netherlands and England.

Likewise, markets are opened for grape on the Asian markets Hong Kong and Taiwan (Department of Agriculture, 2008). There are different growing of vine varieties; each one has different characteristics that were developed according to the demands of the consumers in countries such as Chile, Italy and Peru. Technology has been implemented to allow the production of highly varieties Commercials like: Superior Seedless, Thomson Seedless, Flame Seedless, Crimson Seedless, Red Globe. The growing of vines is being threatened by different diseases; highlighting among them the gray and acid rot. It is manifested with the existence of microcracks or wounds in the cuticle of the fence being the cause of the entry of yeast and bacteria, those that intervene as an infectious agent primary, followed by fungi as secondary agents. (Gravot, et al., 2001).

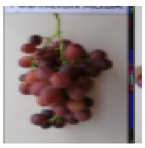
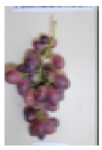
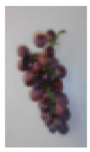
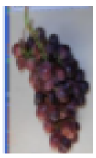
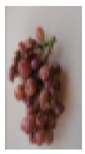
Elad, et al., (2004), says that B. cinerea isa family filamentous fungus Sclerotinicaeae, capable of infecting to more of 230 species of host plants. This way, the sources of inoculum in the crop they are multiple, given their possibility of infecting and survive in green and dead parts of own crop and weeds adjacent.

The present work is justified because exists an increase in production losses and quality due to the presence of rot gray and acid rot, these two diseases are generating great interest in the search for solution alternatives for your control. However, due to the fact that acid rot has as causal agents a set of microorganisms from different biological groups such as fungi, bacteria and yeast. Likewise, Botrytis cinerea is a fungus, the control becomes more complex because there have to be included products that restrict the development of pathogens; their broad adaptability in different areas worldwide and those they do not generate residuals, since the disease occurs at the stage of production harming the crop.

Method

In the present investigation, it has been established a **Design of Complete Blocks at Random** (DBCA), witnesses were not included only specific treatments, being 5 treatments with 4 repetitions giving a total of 20 analysis units evaluated their respective analysis of variance (ANAVA). In addition, to establish differences between treatments, the Duncan Test was used for a level of significance of 5% ($P \leq 0.05$). The test is performed in the vineyards of Agricultural Company "San Juan", in the Red Globe, with the purposes of carrying out the monitoring of the effectiveness of Biological products based on Baccillus subtilis. The population was constituted by 1940 plants distributed in all treatment with its respective repetition of vine plants from the 'Red Globe' each treatment whose pattern is Freedom, a distance of 2m x 3m between them, in the production stage from May to December 2015 in the agricultural company San Juan of the Chongoyape district. With referent the population, took a sample of 5 plants per repetition adding 20 plants for each treatment

Table 1 Evaluation parameters according to the severity of the diseases

Cluster severity assessment for silver						
Cluster models for identification of severity (NO ° of sick fences	Acid rot  Grade 0	Acid Rot  Grade 1	Acid Rot  Grade 2	Acid Rot  Grade 3	Acid Rot  Grade 4	Acid Rot  Grade 5
Description according to the degree of severity of gray rot	Cluster completely healthy	Cluster with 1 or 2 Sick fences	Cluster with 3 or 5 Sick fences	Cluster with more of 5 sick fences	More of a shoulder sick almost the half of the cluster affected	More of half of the cluster affected until the 100% Of damage

Results

The incidence of gray and acid rot of the vine (percentage of plants affected by treatment) under 5 treatments evaluated in the different phenological stages of the crop,

They included three applications of the products biological and chemical (See figure 1). The first was 70% flowering, the second to 19 mm in diameter of fences and the third was to 20 mm diameter of fence with 2% pint. To determine the conditions of the field experimental and prevent the incidence and severity of the gray and acid rot, a first evaluation before starting the applications, because the case of gray rot (Botrytis cinerea L.) could have been presented since this phenological stage, however, found in none of the treatments.

During cluster development as can be observe in the evaluations that were made every 10 DD1 ° AP, none of the treatments reported the diseases. However in the evaluation that was made 4 DD2 ° AP, the bunches had already started pint or ripening being at 19.86 mm in diameter of fence, at a maximum temperature of 28.2 ° C and minimum of 17.6 ° C, with 76% relative humidity. Presenting evapotranspiration of 3.86 mm without precipitations, there was an incidence of 15% of diseased plants by treatment that is presented in all the treatments under study. When applying the analysis of variance and the test of Duncan's significance at 0.05 n.s, was not found significant differences between treatments since there was an incidence uniform in all treatments. In the evaluation that was made at 10 DD 3° AP, a 20.5 mm diameter of fence with 10% pint; the maximum temperature of 29.6 ° C and minimum of 18.9 ° C; relative humidity of 76% and 4.26 mm evapotranspiration, it was found that Treatment 5 of B. subtillis (4 L / Ha) was that presented the highest incidence with a value of 15% of plants affected by the disease. On the other hand treatments 1 and 4 of Ipodrione (1,250 Kg / Ha) plus B. subtillis CEPA QST713 (5L / Ha), as well as treatment 4 of pyrimethanil (1.5 L / Kg) plus B. subtillis CEPA QST713 (5L / Ha) presented only 5% of incidence of acid rot.

In figure 2 it can be seen that the acid rot is established by degrees that go from zero to grade 5. Being the grade zero a completely healthy cluster; Following Grade 1 is a cluster with 1 to 2 fences sick Grade 2 cluster with 3 to 5 fences sick Grade 3 cluster with more than 5 fences sick grade 4 with more than one shoulder sick fences and grade 5 is degradation total of the cluster.

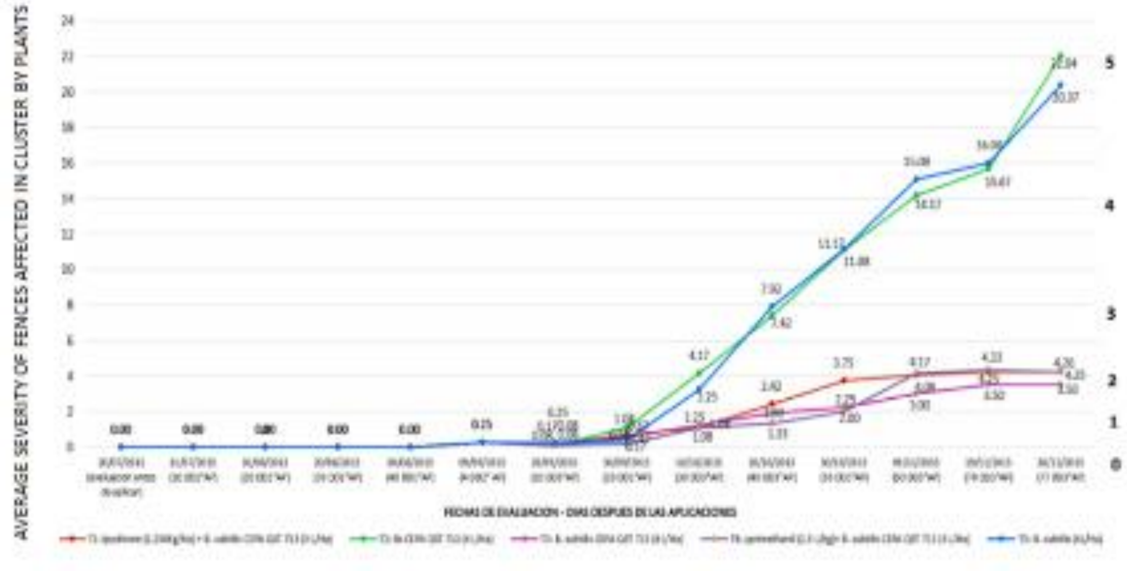
This evaluation parameter is also carried out in the same phenological stages and dates of the incident, initiating a evaluation at 70% flowering with Maximum temperature of 30.3 ° C and minimum of 17.3 ° C. With relative humidity of 73% and evapotranspiration of 3.9 mm, this occurrence happened a day before applying the products, which there was no presence of diseases. Without However, after applying the products, conducted evaluations every ten days until the 40DD1 ° AP and during this period no found severity of rot. In change in the evaluation of 4DD2 ° AP, it observed that the clusters started painting or ripening being at 19.86 mm in diameter of fence; at a maximum temperature of 28.2 ° C and minimum of 17.6 ° C; with 76% of HR. The evapotranspiration was 3.86 mm and it was not they presented precipitations.

An average of 0.25 fences was obtained affected, determining a severity of grade 1 that was observed in all treatments studied. It was not found statistical differences between them, since they presented a uniform severity in all treatments

In figure 3 the average fence is observed scarred in clusters per vine plant, with 5 treatments evaluated in different states phonological. Like the parameters above, was evaluated since the beginning of the fieldwork. However, it did not exist incidence and severity of gray rot and acid in the first phenological stages. In the same way there were no fences healed until when the clusters were found at 20.5 mm in diameter of berry with 10% pint, 10DD3 ° AP presenting a maximum temperature of 29.6 ° C and minimum of 18.9 ° C, the relative humidity was 76% and a 4.26 mm evapotranspiration. The treatments 1, 3 and 5 of Ipodrione (1,250 Kg / Ha) plus B. subtillis CEPA QST713 (5L / Ha), B. subtillis CEPA QST713 (6L / Ha) and B. subtillis (4L / Ha) respectively, had an average of 0.75 fences healed in bunches per plant. On the other hand treatments 2 and 4 of B. subtillis CEPA QST713 (4L / Ha) and pyrimethanil (1.5 L / Kg) plus B. subtillis CEPA QST713 (5L / Ha) presented an average of 0.50 fences healed per effect of the products applied. When applying the products from 70% flowering as a preventive action, the plant has the capacity to absorb these products and store them in their cells. Therefore, when the causal agent of the acid rot enter to cause damage, the plant have the ability to limit their development and proliferate throughout the bunch causing the loss of quality and production.

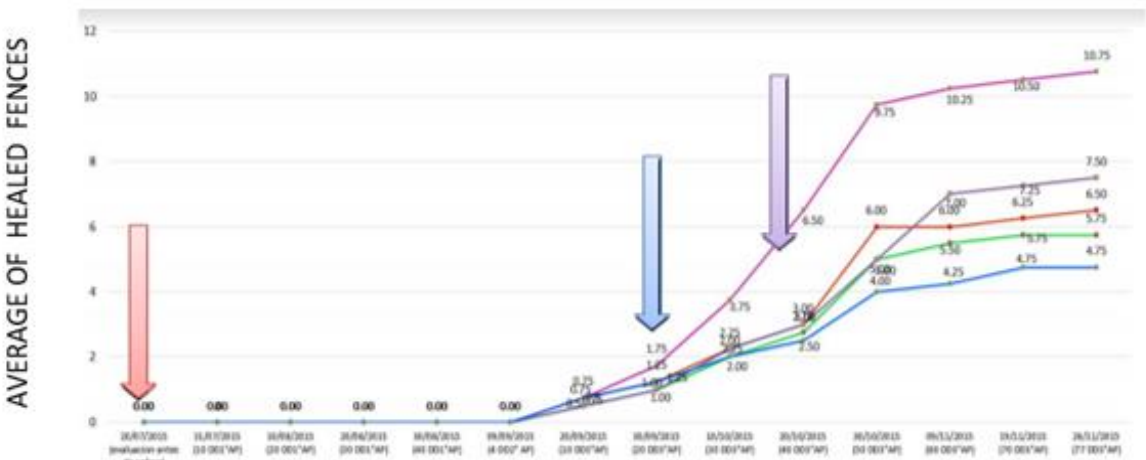
That is why scarring is a clear expression of the products as we can see in the evaluation which was carried out at 40DD3 ° AP. The cluster had 25.6 mm diameter of fence with 76.18% of pint, it had a maximum temperature of 29.4 ° C and minimum of 18.1 ° C. A relative humidity 77% and an evapotranspiration of 4.57 mm. The treatment 3 of B. subtillis CEPA QST713 (6L / Ha) showed an average of 6.50 scarred fences; greater than others treatments such as 2 and 5 of B. subtillis CEPA QST713 (4L / Ha) and B. subtillis (4L / Ha) that only had an average between 2 and 3 fences healed in bunch per plant.

Picture 1. Incidence of the acid rot of the vine under 5 treatments evaluated in different states phenological of the crop.



EVALUATION DATES - DAY AFTER APPLICATIONS

Picture 2. Severity of the acid rot of the vine under 5 treatments evaluated in different states phenological of the crop



EVALUATION DATES - DAY AFTER APPLICATIONS

Picture 3. Average of healed fences of the vine due to the effect of the products applied under 5 treatments evaluated in different phenological stages of the crop.

Discussion

The described results allow to realize a description of them based on the objectives, being the first objective, identify the causative agents of rot Gray and Acid Vine Cultivation (Vitis vinifera) L.); in which no presence of Botrytis was found cinerea I., causal agent of gray rot.

To achieve the second objective, apply the biological and chemical products to control the gray and acid rot in the vine crop in field conditions; the chemical and biological products distributed in 5 treatments. Three applications were made, being the crop in the phenological stage of 70% of flowering, as LISBOA mentions, (2003) who associated biological products and chemicals, where the chemicals were applied in flowering and the biological ones in a stage most sensitive phonological

The second application conclude that its best treatments were cyprodinil + fludioxonil, fenhexamid and pyrimethanil: for the case of the use of biological products, this investigation agrees with Bais et al., (2004). They mention that one of the most studied genres in the subject of the biocontrols is the genus Bacillus sp.

In the third objective, assess the incidence and severity of gray and acid rot in the vine cultivation (Vitis vinifera L.) in each of the treatments proposed in the production stage in the field, the following were taken into account aspects:

Incidence evaluation:

In the initial evaluations it was not found incidence of the disease; however, realized that for the case of gray rot (Botritis cinérea L.) could be presented from flowering as stated by INFOAGRO, (2003) and PÉREZ, (2004), but it did not exist yet report in the region due to the conditions environmental

When the cluster was in a phenological state of 25.6 mm diameter of berry with 76.18% of pint at 40 DD3 ° AP, at a temperature maximum of 29.4 ° C and minimum of 18.1 ° C, arelative humidity of 77% and a

4.57 mm evapotranspiration, it was observed that the incidence of acid rot increased as in treatments 2 and 5 with an incidence of 45% of affected plants for the disease greater than others. Without However, treatment 3 only showed 30% of incidence of plants with acid rot. In these results we find differences significant between repetitions but not between treatments.

Evaluation of severity.

In the case of severity, the damage of the disease in the cluster taking into account the scale formulated by SALGADO et al., (2005). In which severity goes hand in hand with the incidence that in the first assessments of the initial phenological stages of the cluster no positive results were found.

However, when the cluster started, it is already presented the disease and is increasing its degrees of incidence as the cluster increases its maturation and we can see that in the evaluation that was made at 40DD3 ° AP being the crop at 25.6 mm in diameter Berry with 76.18% of pint, presenting a maximum temperature of 29.4 ° C and minimum of 18.1 ° C, a relative humidity of 77% and a 4.57 mm evapotranspiration, treatment 5 of B. subtillis (4 L / Ha) presented an average of 7.92 fences affected in bunches per plant with a grade 3 incidence. Unlike the treatment 1 of pyrimethanil (1.5 L / Kg) plus B. subtillis CEPA QST713 (5L / Ha) presented a average of 1.33 berries affected by cluster corresponding to a grade 1 severity of the acid rot.

The preventive and curative action of the products it manifests itself by scarifying the fences that present the acid rot, avoiding the runoff from juice contaminated by pathogens towards the other fences such as affirms ESTERIO and AUGER, (1997) affirm that

B. subtilis have an antagonistic action and mycoparacitism with the pathogens that enter to the cells of the plants

The healing of the berries was better in the treatment 3 of Bacillus s. CEPA QST 713 (6L / Ha) with an average of 10.75 berries healed

Conclusions

The identification of the causal agents of the gray and acid rot was obtained that did not exist presence of Botrytis cinerea causing the gray rot, however in the case of acid rot if the complex was found microorganisms, mainly bacteria Acetobacter spp, yeasts such as Kloeckera spp and fungi such as Aspergillus niger. Those who caused a good incidence and severity in some of the treatments.

The application of biological products and chemicals was distributed in 3 different stages of the crop to 70% flowering where chemical products were applied for the case of the treatments 1 and 4 that contained Ipodrione and Pyrimethanil for the purpose of avoiding the existence of toxic waste in harvest the rest treatments were of biological product, the second application was at 19 mm in diameter berry or also called cluster closure where All treatments were applied by biological products as well as the third and last application that was at 2% of pint.

For the case of the incidence evaluation and severity of acid rot since rot gray there were no reports neither in the field nor in the analyzes of laboratory, it was tube that treatment 2 where applied Bacillus s. CEPA QST 713 (4L / Ha) and Treatment 5 of Bacillus s. (4L / Ha) presented an incidence of 70% and 75% of affected plants by treatment reaching a degree severity with an average of 22.04 and 20.37 fences. Being statistically superior to others treatments, which did not happen with the others treatments that only reached an incidence from 45% to 50% with a grade 2 severity. Determining that treatment 3 of Bacillus s. CEPA QST 713 (6L / Ha) that I present the minor incidence and severity with respect to others. Therefore, the alternative hypothesis is accepted that less one of the applied products exercised better control of acid rot.

greater than others and treatment 2 of Bacillus s. CEPA QST 713 (4L / Ha) and Treatment 5 of Bacillus s (4L / Ha) presented only an average of 5.75 and 4.75 of fences healed respectively. Existing Significant differences between treatments accepting thus the alternative hypothesis that at least one of applied products exercised better control of the acid rot of the vine.

References

Araya, Claudia. Efectividad de diferentes tratamientos químicos para el control pre y pos-cosecha de pudrición ácida en uva de mesa cv. red globe, en cuatro regiones de Chile. Tesis (ingeniero agrónomo). Valparaíso Chile: Pontificia Universidad Católica de_Valparaíso,_2006._Disponible_en_http://www.sidalc.net/cgibin/wxis.exe/?IsisScript=BIBACL.xis&method=post&formato=2&cantidad=1&expresion=mfn=033740.

Barboza, Corona; Vasquez, Humberto; Salcedo, Rodolfo y Bautista Justo. Probioticos y Conservadores Naturales de Alimentos [en linea] vol. 14, num 3. Guanajuato - Mexico., Santiago : Acta Universitaria , 2004 [fecha de consulta: 18 de septiembre del 2015]. Disponible en: http://www.redalyc.org/articulo.oa?id=41614304 .

Barriga, Nicolas. Evaluación de la efectividad en campo de un producto clorado en el control de hongos asociados a pudrición acida en vid cv.cabernet sauvignon. Tesis (Ingeniero agronomo). Chile: universidad de talca, 2009. Disponible en: http://dspace.utalca.cl/handle/1950/7373.

Calvo, Pamela y Zuñiga, Doris. Caracterización fisiológica de cepas de Bacillus spp. aisladas de la rizósfera de papa (Solanum tuberosum), [en linea]. vol. 09 N°01. Departamento Académico de Biología, Universidad Nacional Agraria La Molina, Lima – Perú. 2010 [fecha de consulta: 30 de septiembre del 2015]. Disponibleen://www.lamolina.edu.pe/ecolapl/Articulo_4_No_1_Vol_9.pdf. ISSN 1726-2216

Franck, J. la pudricion acida de la vid. Tesis (Magister en Ciencias Vegetales) Santiago -Chile. Pontificia Universidad La Catolica de Chile. Facultad de Agronomía e Ingeniería Forestal. 2003.

LaTorre, Bernardo; Zaffoli, Juan Pablo y Viertel, Spadaro. Aportes al conocimiento de la pudricion acida de la uva de mesa en Chile.Revista Aconex [en linea]. Abril - Junio 2009, nº 102. . [Fecha de consulta: 22 de agosto del 2015]. Disponible en:http://www.portalfruticola.com/assets/uploads/2010/05/aconex.pdf. ISSN: 0716-7385.

Lisboa, Mario. Efectividad de Bacillus Subtilis y de una cepa nativa de Trichoderma harzianun sobre la incidencia y severidad de pudricion gris (Botrytis cinerea) en Vid vinifera L. [en linea]. Tesis (Ingeniero agrónomo). Talca - Chile. Universidad de Talca, 2003. Disponible en: http://dspace.utalca.cl/bitstream/1950/919/3/MLisboaM.pdf