

TraceLemon, prototipo para la trazabilidad de la cadena productiva del limón en el estado de Colima

TraceLemon, Prototype for the Traceability of Lemon Productive Chain in the State of Colima

TraceLemon, um protótipo para a rastreabilidade da cadeia de produção de limão no estado de Colima

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Resumen

El presente prototipo tecnológico tiene como principal objetivo contribuir al mejoramiento de la comercialización del limón mexicano producido en el estado de Colima, con esta mejora se proyecta ampliar el ingreso a los mercados nacionales e internacionales. Para el desarrollo de este proyecto se utilizaron herramientas de análisis, diseño y programación, de las cuales destacan el Enterprise Architect Project, PHP, AngularJS, Bootstrap, con soporte en la metodología del Proceso Unificado Ágil (PUA). Cabe señalar que este proyecto responde a una investigación mixta con alcance descriptivo, por una parte la investigación documental consistió en estudiar las normas nacionales (Manual de Buenas Practicas

Agrícolas) e internacionales (GLOBALG.AP) que promueven la certificación de los procesos de producción agrícolas, y por otra parte la investigación aplicada con los miembros del Consejo Estatal de Productores de Limón (COEPLIM) que contribuyó a identificar las actividades para el manejo del cítrico; ambas investigaciones permitieron conceptualizar y describir las actividades de la cadena productiva para su implementación en este sistema. Como resultado se presenta la funcionalidad de TraceLemon, destacando la trazabilidad interna de una cosecha de limón apegada al Sistema de Trazabilidad de Productos Hortofrutícolas para Consumo en Fresco de los Estados Unidos Mexicanos, misma que se muestra en el código de barras que se registra en sistema y se coloca en las cajas de la cosecha; la estimación de la utilidad de la producción del cítrico mencionado por parcela; el registro diario de las actividades de manejo del cultivo y los datos generales de productores, parcelas y actividades. TraceLemon es una herramienta prototipo que actualmente se encuentra en versión beta, e innovará en el sector agrario colimense con amplias expectativas de impactar en las tareas del productor de limón principalmente en dos vertientes, ayudar a la pronta certificación de los procesos productivos por organismos nacionales e internacionales y por otra ayudar a que el productor conozca la utilidad de la parcela en un periodo dado, lo cual le traerá como consecuencia tomar mejores decisiones al momento de invertir y detectar posibles anomalías en el manejo de la parcela. Con base en lo anterior TraceLemon se proyecta para mejorar la producción, calidad y distribución del limón tanto en los mercados nacionales como internacionales, como respuesta a la vocación del estado de Colima citada en el Plan Estatal de Desarrollo 2016 – 2021.

Palabras clave: trazabilidad, cadena productiva, limón, sistema web.

Abstract

The present technological prototype has as main objective to contribute to the improvement of the commercialization of the Mexican lemon produced in the state of Colima, with this improvement is projected to expand the income to national and international markets. For the development of this project, we used analysis, design and programming tools, such as Enterprise Architect Project, PHP, ANGULARJS, BOOTSTRAP with support in the Agile

Unified Process (PUA) methodology. It should be noted that this project responds to a mixed research with descriptive scope, on the one hand documentary research consisted of studying national standards (Manual of Good Agricultural Practices) and international (GLOBALG.A.P) that promote the certification of agricultural production processes , And on the other hand the applied research with the members of the State Council of Producers of Limón (COEPLIM) that contributed to identify the activities for the management of citrus; Both investigations allowed to conceptualize and describe the activities of the productive chain for its implementation in this system. As a result, the TraceLemon functionality is presented highlighting the internal traceability of a lemon crop adhered to the Traceability System of Fresh Fruit and Vegetable Products of the United Mexican States, which is shown in the bar code that is recorded in the system and Places in the boxes of the crop; Estimating the utility of citric production per plot; The daily recording of crop management activities and the general data of producers, plots and activities. TraceLemon is a prototype tool currently in beta, and will innovate in the agricultural sector in Colima with broad expectations of impacting on the tasks of the lemon producer mainly in two aspects, help the early certification of production processes by national and International and on the other hand help the producer to know the usefulness of the plot in a given period which will result in better decisions when investing and detect possible anomalies in the management of the plot, based on the above TraceLemon is Project to improve the production, quality and distribution of lemon in both national and international markets in response to the vocation of the state of Colima cited in the State Development Plan 2016-2021.

Key words: Traceability, production chain, lemon, web technologies.

Resumo

O protótipo tecnológico atual tem como principal objetivo contribuir para a melhoria da comercialização do limão mexicano produzido no estado de Colima, com esta melhoria se prevê expandir a renda para os mercados nacionais e internacionais. Para o desenvolvimento deste projeto, utilizamos ferramentas de análise, design e programação, como Enterprise Architect Project, PHP, AngularJS, Bootstrap, com suporte na metodologia Agile Unified

Process (PUA). Deve-se notar que este projeto responde a uma pesquisa mista com escopo descritivo, por um lado, a pesquisa documental consistiu em estudar padrões nacionais (Manual de Boas Práticas Agrícolas) e internacionais (GLOBALG.AP) que promovem a certificação de processos de produção agrícola E, por outro lado, a pesquisa aplicada com os membros do Conselho Estadual de Produtores de Limón (COEPLIM) que contribuiu para identificar as atividades de gestão de citros; Ambas as investigações permitiram conceituar e descrever as atividades da cadeia produtiva para sua implementação neste sistema. Como resultado, a funcionalidade TraceLemon é apresentada, destacando a rastreabilidade interna de uma cultura de limão anexada ao Sistema de rastreabilidade de frutas frescas e vegetais para os Estados Unidos do México, que é mostrado no código de barras que está registrado no sistema E colocado nas caixas da cultura; Estimar a utilidade da produção cítrica por parcela; O registro diário das atividades de manejo de culturas e os dados gerais de produtores, lotes e atividades. O TraceLemon é uma ferramenta de protótipo que está atualmente em versão beta e inovará no setor agrícola em Colima, com amplas expectativas de impactar as tarefas do produtor de limão principalmente em dois aspectos, ajudando a certificação precoce dos processos de produção por meio de recursos nacionais e E por outro lado, ajude o produtor a conhecer a utilidade da trama em um determinado período, o que levará a melhores decisões ao investir e a detectar possíveis anomalias na gestão da trama. Com base no TraceLemon acima mencionado, é projetado para melhorar a produção, qualidade e distribuição de limão nos mercados nacionais e internacionais, em resposta à vocação do estado de Colima, citada no Plano de Desenvolvimento do Estado 2016-2021.

Palavras-chave: rastreabilidade, cadeia de produção, limão, sistema web.

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Introduction

According to data from the Agro-Food and Fisheries Information Service, Mexico is the second largest producer of lemon in the world by producing 2,120,613 tons in 2015, and plantations are the second in extension, in which 13.9% of world volume is harvested; India is the first producer to produce 2,523,500 tonnes in that year (Agri-Food and Fisheries Information Service [SIAP], 2016).

On the other hand, in Mexico 79,456 hectares are cultivated with Mexican lemon (*Citrus aurantifolia*). Michoacán, Colima, Oaxaca and Guerrero are the main states where the designated cultivation area is distributed. The annual production is over 1.12 million tons, which reach an estimated value of 254 million dollars (Secretary of Agriculture, Livestock, Rural Development, Fisheries and Food [SAGARPA], 2015). In the State of Colima the lemon is one of the characteristic fruits of the region, it is distributed in eight of the 10 municipalities. Tecomán and Armería is where the largest area dedicated to the crop is concentrated with 88.9% (Orozco et al, 2014).

Nowadays, the cultivation and production of the lemon requires different activities so that the harvest is competitive in quantity and quality; These activities are generating employment since tasks such as planting and maintaining orchards, harvesting, transportation, packing and marketing, among others, are included. According to Orozco. Et al (2014) it is estimated that 20,000 families are directly and indirectly benefited by the production, commercialization and industrialization of the lemon.

In recent years lemon production has been impacted by a number of factors, most importantly the HLB plague known as the "Yellow Dragon", which has reduced the volume of harvest due to the ravages in lemon production affecting the Colima producers . "Previously there was a production of 550 thousand tons of lemon; Currently, following the problem of the Yellow Dragon, production fell to 270 thousand" (*Salazar, 2014*).

There are also other factors, such as the technological one, which, because of the importance it has for the state: the land's vocation for cultivation, a large area of cultivation, a generator of jobs and beneficiary families, should be considered for a more efficient management of Productive chain, understood as the sowing, handling, harvesting and sale of lemon. Nowadays technologies have become important for society, in any field, be it labor, education or government help to perform better daily activities and to have a better quality of life.

One of the tools we can count on are web technologies. Lujan defines a web application as "a special type of client / server application, where both the client (the browser, browser, or viewer) and the server (the web server) and the protocol through which they communicate (http) are standardized And are not to be created by the application programmer "(Lujan, 2002). Web applications are of great importance since they are executed in any operating system and in the different web browsers, saving time because through them you can consult information or buy online, among other things. With just having an Internet connection and a computer, tablet or smart phone can be accessed from anywhere, helping to have detailed information about the lemon and thus know the processes to which it has submitted, all through a web information system.

Another factor is good practice described as "... it is a successful experience, one that has been tested and validated, in a broad sense, that has been repeated and deserves to be shared in order to be adopted by the greatest number Potential of people "(Food and Agriculture Organization of the United Nations [FAO], 2013). To date, the associated producers in the State Council of Lemon Producers (COEPLIM) lack a quality management system that allows them to identify a standard in the activities that they perform for the management of the production, harvest and sale of the lemon. However, they recognize the importance of implementing them in the cultivation and harvesting of lemon because they can contribute to improve the quality and volume of the harvest, reduce costs and prolong the production period.

Another factor that had not been addressed was Traceability, according to ISO: 2008 (2008) the organization must identify the state of the product with respect to the requirements of monitoring and measurement throughout the realization of the product, while SAGARPA defines To the traceability of food as "the ability to reconstruct the history of a product and the conditions that surround it throughout the entire food chain, ie from farm to table" (SAGARPA, 2014), while Opara States that "agricultural traceability refers simply to the collection, documentation, maintenance and application of information related to all processes in the supply chain which guarantees the consumer and other stakeholders the origin, location and life history of a Product, as well as assistance in crisis management in case of a quality violation "(Opara, 2003), this traceability allows to know the management that your The plant from the time it was planted until it was acquired by the customer, and through the bar code which is defined by the GS1 as "an image that identifies a product in a standardized and unique way worldwide" (GS1, Sf), it will be able to identify the essential information of the product; To do this, it is necessary to record the management activities inherent to the production, harvesting and sale of the lemon, including planting, pruning, macheteo, desvare, tracking, irrigation, nutrition and pest and disease management, as well as harvesting and selling product; These records allow us to know the internal traceability of a crop, that is, the management in production, what activities are carried out, who does them and how much is invested; What inputs were purchased and what were applied, how much is invested in the lemon harvest, how much is invested in the transfer or commercialization of lemon, the extent to which technology is incorporated, and good management and marketing practices. According to Opara (2003), the benefits of integrating traceability into the general quality agricultural management system are numerous, from improvements in product quality, safety management, crisis management in case of safety alert and strengthening of The global coordination of agribusiness.

At the moment the management of the productive activities of any company is strengthened if it is supported with technological and computational tools that allow to register the basic data of its operations to be able to project the economic indicators that give permanence to the crop and harvest of lemon.

Several authors have carried out research on the production, harvest and sale processes to manage their agricultural products, including the thesis Software for the Agricultural Sector (Albornoz, 2006), which presents an approximate diagnosis of the current situation in the relation Between the computer sector and the agricultural sector in the pampean region of Argentina, both in terms of the use and development of software applied to the different activities included in the agro-food chain. This work took the form of exploratory qualitative research, through interviews with organizations and institutions in the region. One limitation is that information was only collected on the information supply in the agricultural sector in the region. The results of the study show that there is little link between IT supply and agricultural demand.

On the other hand, Seismografo (2007) is a web tool for the agricultural sector that allows to control all the business, from the productive state of the lots with their yields to the schedule of the tasks of simple form; Campaigns can be planned and costs automatically calculated, recording the use of fertilizers, agrochemicals, machinery and working hours. One of the limitations is that forward traceability is not contemplated in the unpaid version and this software implies licensing.

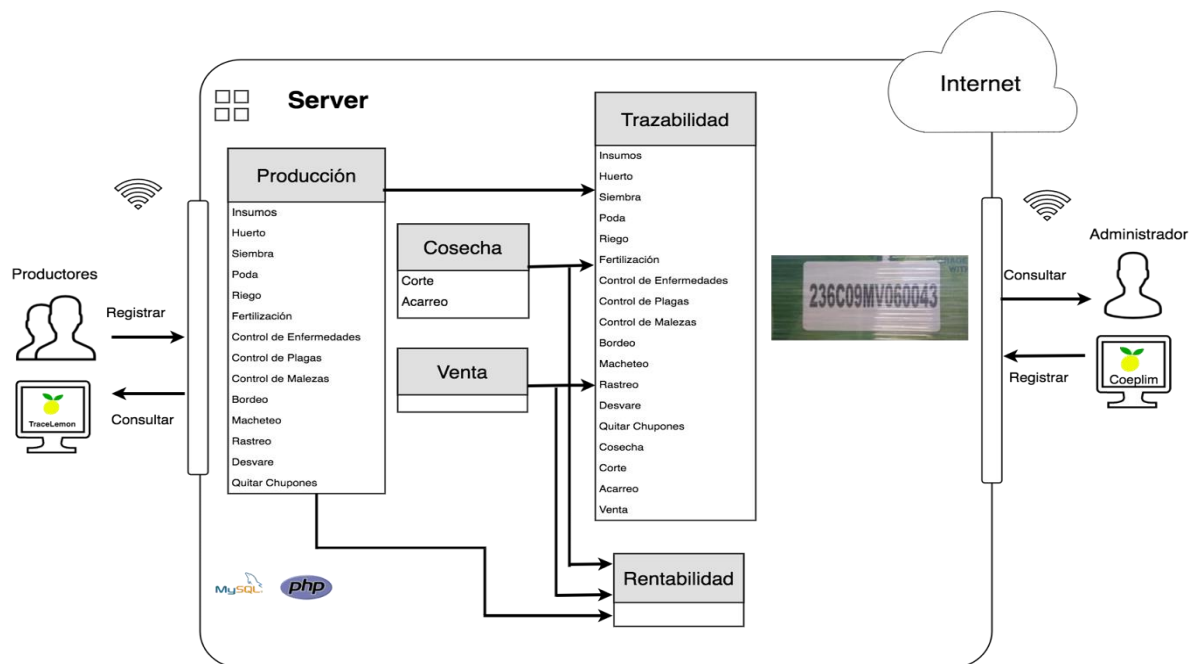
Hence the justification to develop TraceLemon, currently as a prototype Web System for the Traceability of Lemon Production in the State of Colima, developed with free code technologies, which allows standardizing and documenting lemon management activities in relation to Traceability System of Fruit and Vegetable Products for Fresh Consumption in the United Mexican States, carry out an adequate administration of the activities carried out in the production process, harvest and commercialization of the lemon, know the internal traceability by harvest from its origin to its commercialization, as well How to know the utility of the production of a given parcel.

Revised the state-of-the-art technologies that support the agro-food sector, we present in this article TraceLemon, Prototype for the Traceability of the Lemon Productive Chain in the State of Colima whose innovation lies in the attention to the standards and manuals of good agricultural practices Such as the Manual of Good Agricultural Practices (Centro de Investigación en Alimentación y Desarrollo AC [CIAD], 2002), Traceability System for

Fresh Fruit and Vegetable Products of the United Mexican States (SAGARPA, 2014) and the Base Module for All Types Of Finca (GLOBALG.AP, 2016), to record the information of the management activities and to show them in a bar code that facilitates the traceability of the production, harvest and sale of the lemon; The system also considers the estimation of the usefulness of the citric production mentioned per plot; Therefore the objective of this project is to contribute to the improvement of the marketing of Mexican lemon produced in the state of Colima, with this improvement is projected to expand the income to national and international markets, improve the economic indicators of producers and Increase the usefulness in the cultivation of lemon.

Figure 1 is the conceptual model of TraceLemon, describes the interaction between users and the system, as well as the elements of information technologies necessary for their deployment in the operating environment. Users are the producers of lemon and the Administrator, the latter being an employee of COEPLIM. Both users have different privileges, so they can access various system modules.

Figure 1. Modelo Conceptual TraceLemon.



Elaboración propia: Valencia et al, 2017.

The producer records production, harvesting and sales data using a web browser, either by computer or mobile device, in the latter the adaptive web design feature of the system stands out. You can also immediately consult the information on your plots, crops, monitoring and investments in management activities, and the customer to whom you sell the harvest or part of it. However, the most important thing is that you can know the traceability of a crop, from when it was planted until it was sold. What, how, when and to whom are some of the questions that are answered with traceability, so the final customer or producer can know how a particular crop was handled by scanning the barcode that provides the traceability of that crop. The system additionally indicates the usefulness of the crops per plot, also per producer from the investment records that have. On the other hand, the administrator can enter the system to register the data corresponding to the catalogs that provide operational information corresponding to the use that the producer makes of the system.

Methods

The research methodology employed rests on the mixed approach, because it combines documentary and field techniques; The first with an exploratory scope to know the importance for the producer to attend efficiently and effectively the processes in which he participates; The second with a descriptive scope that allows the measurement of the variables that impact on the management and harvesting of lemon. To ensure representativeness of the sample, cluster sampling has been used (Hernández, 2006), specifically the single-stage survey; It considered the participation of all COEPLIM member producers that use some computational tool to register their processes.

With the information obtained, the processes performed by the lemon producers were known and TraceLemon was implemented for recording and obtaining advanced information. The development of the system was based on the Agile Unified Process (PUA) methodology, which identifies the phases of initiation, elaboration, construction and transition for the product launch, previously considering the modeling, implementation, testing, deployment, management Configuration, project management and environment (EcuRed, 2016). This

methodology is useful for short projects because of the adaptability and flexibility it offers to the Software Engineering process.

All phases of the PUA address business modeling, requirements, analysis and design, implementation, testing, deployment; As well as the transversal disciplines of configuration and administration of change, project management and monitoring in the operational environment. It should be noted that in the elaboration phase there were two cycles to design and test the models with the users; In the construction phase six iterations allowed coding and testing the functional requirements prioritized by the client; The transition was deployed in two cycles that were used to enable the system on the server, train end users and evaluate system acceptance. The cycle was defined for a period of four weeks to develop the functional requirements prioritized by the client.

Results

Proposal

TraceLemon is designed for the web environment, aimed at producers associated with COEPLIM, and its purpose is to support producers so that in the short term they can be candidates for a certification of their lemon crops by favoring the mechanisms that guarantee the safety of their products. At the same time, TraceLemon is intended as the default computer tool for monitoring lemon growing activities, basically considering the internal traceability of the product per harvest and partial traceability backwards and forwards. This traceability is shown in a bar code that can be generated and consulted by both the producers in particular and by COEPLIM.

Elements of Tracelemon

In order to access TraceLemon, the Producer must be previously registered by COEPLIM, once registered, access the system remotely and can register the plots that it possesses with its respective characteristics, also the activities carried out daily in each plot. These activities are presented in Figure 2 - TraceLemon Main Menu, with eleven options for the storage, retrieval and distribution of information pertinent to the activities of planting, handling,

harvesting and selling lemon. At the beginning there is a news stack, by default the most recent ones are shown.

Figure 2. TraceLemon Menú principal.



Elaboración propia: Valencia et al, 2017.

This system for its operation requires the data recorded in the catalogs shown in Figure 3 - TraceLemon Catalogs. In each case, for the only time, the administrator or producer registers the general data of News, Provider, Input type, Input, Rootstock, Variety, Producer, Plot, Buyer, Activity type, Activity, Property regime, Disease type, Disease and Responsible; This data is managed dynamically in the views for recording the daily management activities.

Figure 3. Catálogos de TraceLemon.



Elaboración propia: Valencia et al, 2017.

In the option Analysis records the results of studies of soil, water and leaf conditions, the latter also called leaf; Figure 4 - Foliar Analysis Consultation, shows the results recorded by the producer in a specific way, among them the most significant ones: phosphorus, potassium, calcium and magnesium.

Figure 4. Consulta de Análisis de Foliar.

#	Fecha	Fosforo	Potasio	Calcio	Magnesio	Editar
3	2017-06-06	1	1.1	0.54	0.2	
4	2017-06-06	1	0.05	0.32	0.24	

Elaboración propia: Valencia et al, 2017.

In Figure 5 - Insumos, the results recorded for the purchase of inputs are shown, the most significant data shows the trade name, active ingredient, quantity in liters or kilograms and the price of said input.

Figure 5. Insumos.

#	Nombre Comercial	Ingrediente Activo	Cantidad	Medida	Precio
1	HORTIFRUT	HOLA	6	LTS	\$7.00
2	HERBICIDA FAENA	LIFOSFATO	6	LTS	\$2.00

Elaboración propia: Valencia et al, 2017.

In Figure 6 - Cultivation, the recorded results are shown regarding the cultivation of the plot, among the most significant data shows the type of irrigation, variety and rootstock.

Figure 6. Cultivo.

#	Parcela	Tipo de Riego	Variedad	Portainjerto	Editar
2	NOGALES	GRAVEDAD	SINGLE	CITRUS VALKAMERIAANA	
1	NOGALES	GRAVEDAD	PERSA	NARANJO AGRIO	

Elaboración propia: Valencia et al, 2017.

In Figure 7 - Irrigation, the recorded results regarding the irrigation of the plots are shown, among the most representative data are the date of irrigation and the total water irrigated in the plot.

Figure 7. Riegos.

#	Fecha	Total
1	2017-05-17	1500 LTS
2	2017-04-21	1000 LTS

Elaboración propia: Valencia et al, 2017.

In Figure 8 - Nutrition, the recorded results regarding the nutrition of the plots are shown; When a lemon parcel is nourished, the date, plot, type of application, input applied, as well as the total amount of fertilizer used, the method of application and the amount of fertilizer per plant are recorded.

Figure 8. Nutrición.

The screenshot shows the 'Nutrición' interface with the following filters:

- Tipo de Aplicación: SUELO
- Parcela: MARIA
- Fecha: 2017-05-23

Insumo	Cantidad	Medida	Metodo	Cantidad Planta	Medida
BENOMIL	2	KG	BOLEO	100	GRAMOS
LIFOSFATO	2	KG	TAPADO	100	GRAMOS

Elaboración propia: Valencia et al, 2017.

Producers can have more than one parcel of lemon, and can check the expenses they have made in them for the various activities. Figure 9 - Expenses, shows the dates on which these expenses were incurred with their respective amount; In case you want to consult, the Detail is shown by pressing the respective button and you can check which activities have been reversed.

Figure 9. Gastos.

#	Fecha	Parcela	Total	Detalle
1	2017-04-20	MARIA	\$600.00	
2	2017-03-20	NOGALES	\$1,600.00	
3	2017-06-22	NOGALES	\$1,000.00	

Elaboración propia: Valencia et al, 2017.

The Producer can also know on what dates and how much he has harvested, in addition to who has sold his harvest, in Figure 10 - Harvest and Sales, shows the recorded results regarding the harvest of the plots of a certain Producer.

Figure 10. Cosecha y Venta.

#	Fecha	Parcela	Kilos	Comprador
1	2017-04-20	MARIA	1000	EMPAQUE LIMONES CITRO
2	2017-03-20	NOGALES	2000	CITROJUGO
3	2017-06-22	NOGALES	280	EMPAQUE LIMONES MORENO

Elaboración propia: Valencia et al, 2017.

As the lemon is a disease-sensitive product, producers are obliged to have controls on the gardens, for this they take samples that they send to certified laboratories, the results register them in the system and they have them available at any time for the respective monitoring , Figure 11 - Controls, shows the above information.

Figure 11. Controles.

#	Fecha	Parcela	Tipo	Problema Fitosanitario	# Muestras	# Encontrados	Decisión Tomada	Responsable
1	2017-02-02	MARIA	PLAGA	HLB	7	2	podar	JUAN SANCHEZ
5	2017-02-08	NOGALES	PLAGA	HLB	3	1	poda	ANDREA PIRLO
2	2017-02-02	NOGALES	MALEZAS	OTRO	2	3	fumigar	ANDREA PIRLO

Elaboración propia: Valencia et al, 2017.

When the controls report phytosanitary problems the Producer must establish an integral management that declares in the system, in the option of Disease management. Figure 12 - Integral Management, shows the period of attention to eradicate the problem, the person in charge of care and in Details shows the application of products defined in the treatment.

Figure 12. Manejo Integral.



#	Fecha	Parcela	Problema Fitosanitario	Fecha Inicio	Fecha Fin	Fecha Sig. Corte	Responsable	Detalle
1	2017-05-18	NOGALES	HLB	2017-05-18	2017-05-18	2017-05-18	JUAN SANCHEZ	

Elaboración propia: Valencia et al, 2017.

The producers can consult the expenses that they have made in their plots by the diverse activities in a period of time, as well as to consult the amount of the realized sales in that period; Figure 13 - Utilidad por Parcela, shows the profit from sales income and expenses for activities of the selected period and parcel.

Figure 13. Utilidad por Parcela.



Selecione Parcela:

Fecha Inicio:

Fecha Fin:

Parcela: NOGALES

ACTIVIDADES	COSTOS
DESVARE	\$1,000.00
PODA	\$1,000.00
RIEGO	\$1,008.00
TOTAL	\$3,008.00

VENTAS TOTALES	COSTOS TOTALES	UTILIDAD
\$18,900.00	\$3,008.00	\$15,892.00

Elaboración propia: Valencia et al, 2017.

As a contribution of this technological development is the traceability of a crop, this is shown in Figure 14 - Traceability by Harvest, and its format is attached to the Traceability System of Fresh Fruit and Vegetable Products of the United Mexican States (SAGARPA, 2014), which establishes the following information as basic in the traceability of agricultural products: by harvesting the data considered are home garden, orchard register, crop, batch number, harvest date, buyer and buyer registration, also shown The bar code generated. This code can be read and displayed the information referred to.


Figure 14. Trazabilidad.

Trazabilidad

Código de Barras

750090020001805300103116

Huerta Origen:	Nogales
Huerta Registro:	0001
Cultivo:	80530
Numero de lote:	03116
Fecha de cosecha:	31/01/2016
Comprador:	Empaque Limones Tecomán
Registro Comprador:	0007



750090020001805300103116

Elaboración propia: Valencia et al, 2017.

Conclusion

TraceLemon is a tool that will innovate in the agricultural sector of Colima with broad expectations of impacting on the tasks of the lemon producer, mainly in two aspects, collaborate to the prompt certification of the productive processes by national and international organisms, and help the producer Know the usefulness of the plot in a given period, which will lead you to make better decisions when investing and to detect possible anomalies in the management of the plot.

The Colima field is a priority in the state's public policies, in this particular case COEPLIM is an organ interested in implementing actions to make producers more competitive and have tools to evidence quality products by following formal standards and meeting the need Of the national and international market, attending and improving every day the processes of harvest and production of lemon. TraceLemon adheres to a national quality standard, but with universal criteria that allow in the short term an escalation to an international standard.

Table 1 - Characteristics of TraceLemon shows the most important characteristics of the application, including information on the traceability of the harvest implemented in a bar code so that the final customer can know the most important information of the product.

Table 1. Características de TraceLemon.

Dirigido a:	Productores, COEPLIM
Requerimientos:	Una computadora
Navegador:	Chrome
Funcionalidades:	<ul style="list-style-type: none">• Noticias recientes sobre el cultivo, mejores prácticas, cosecha y venta de limón.• Reportes:<ul style="list-style-type: none">○ Análisis (agua, foliar, suelo).○ Inventario de insumos.○ Nutrición.○ Manejo integral de enfermedades.○ Gastos.○ Ventas.○ Utilidad.○ Trazabilidad de cosecha.

Elaboración propia: Valencia et al, 2017.

Producers, knowing immediately and integrally the information about the investment that has made in a plot can identify if the management has been pertinent, opportune or profitable; Whether they should take action to anticipate or address potential risks; Or other actions to improve their profit margins.

Future Work

It is suggested that whoever retakes this research and technological development can expand the scope by extending the information of the internal traceability code, with data that indicate other norms regarding the safety, this will be facilitated because TraceLemon already registers the activities of management of the chain of production of the lemon; Also, incorporating in the same code the traceability back and forth of the harvested product, this so that the final customer can have more complete information of the innocuity of the product that acquires, distributes or consumes.

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