Volume 2, Issue 3 – July – December - 2016

E C O R F A N

Journal-Republic of Paraguay

ISSN-On line: 2414-4827

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ECORFAN Journal-Republic of Paraguay, Volume 2, Issue 3, July-December 2016, is a journal edited semestral by ECORFAN. Alberdi N°105 almost Rivarola Captain, C.P. 2060, Ciudad de Luque, Central Department, Paraguay.Postcode:11500WEB:www.ecorfan.org/republicofparaguay/,journal@ecorfan.org. Editor in Chief: RAMOS-ESCAMILLA, María. ISSN-2414-4827. Responsible for the latest update of this number ECORFAN Computer Unit.Escamilla BOUCHÁN-IMELDA, Luna SOTO-VLADIMIR, Alberdi N°105 almost Rivarola Captain, C.P. 2060, Ciudad de Luque, Central Department, Paraguay. Postcode:11500 last updated December 31, 2016.

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Presentation

ECORFAN Journal-Republic of Paraguay is a research journal that publishes articles in the areas of:

Political Science, Economics, Public Policy, Economic Development and Technology and Innovation

In Pro-Research, Teaching and Training of human resources committed to Science. The content of the articles and reviews that appear in each issue are those of the authors and does not necessarily the opinion of the editor in chief.

In this Number presented an article *Development of a product based on fruit-honey* by LAZCANO-HERNÁNDEZ, Martin, OCHOA-VELAZCO, Carlos, ÁVILA-SOSA-SÁNCHEZ, Raúl and MENA-PACIÓ Natalia with adscription in the Benemérita Universidad Autónoma de Puebla, in the next Section an article *Patents in a public research center: the case of the national institute of forestry, agricultural and livestock (INIFAP)* by MOCTEZUMA-LÓPEZ, Georgel, ESPINOSA-GARCÍA, José Antonio, VELÁZQUEZ-FRAGOSO, Lourdes and ROMERO-SÁNCHEZ, Martín Enrique, in the next Section an article *Engineering process for the injection of carbon black in suspension applied directly to the polymer to obtain pigmented acrylic fiber* by ESPINOSA-SOSA, Enrique, LUGO-DEL ANGEL, Fabiola, PULIDO-BARRAGAN, Eder and CRUZ-SUSTAITA, Vianey, in the next Section an article *Using Petri nets in modeling automatic seeder for germination trays* by DE ANDA-LÓPEZ, Rosa, TABAREZ-PAZ, Israel and BETANZOS-CASTILLO, Francisco with adscription in CIATEQ-UTSEM, UAEM, UACH respectively.

Content

Article	Page
Development of a product based on fruit-honey	1-10
Patents in a public research center: the case of the national institute of forestry, agricultural and livestock (INIFAP)	11-18
Engineering process for the injection of carbon black in suspension applied directly to the polymer to obtain pigmented acrylic fiber	19-24
Using Petri nets in modeling automatic seeder for germination trays	25-31
Instructions for Authors	
Originality Format	
Authorization Form	

Article **ECORFAN Journal**
December 2016 Vol.2 No.3 1-10

Development of a product based on fruit-honey

LAZCANO-HERNÁNDEZ, Martin*†, OCHOA-VELAZCO, Carlos, ÁVILA-SOSA-SÁNCHEZ, Raúl and MENA-PACIÓ, Natalia

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Received June 11, 2016; Accepted November 23, 2016

Abstract

Food needs in the local population is varied require many colors, aromas and flavors. We therefore is require innovative products such as fruit jams uncommon as blueberry replacing sugar with honey. It formulates a based fruit -honey product to obtain a sensorial acceptable jam between various formulations. Sensory distinguished color is not different, but in aroma, flavor and general appearance is established that the best accepted is the formulation with 50 % fruit and 50 % honey. The best accepted sensory jam (400 g honey, 400 g fruit) was performed according to determinations physicochemical test and costs. The physicochemical analysis shows that the jam has obtained the necessary criteria to meet Mexican Standards of Quality. The cost for processing is available for the production of a small company and great feasibility to be marketed.

Honey, Jam, Blueberry

Citation: LAZCANO-HERNÁNDEZ, Martin, OCHOA-VELAZCO, Carlos, ÁVILA-SOSA-SÁNCHEZ, Raúl and MENA-PACIÓ, Natalia. Development of a product based on fruit-honey. ECORFAN Journal-Republic of Paraguay. 2016, 2-3: 1-10.

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Introduction

Healthy, balanced and preventive food based on a rigorous scientific basis is not an unnecessary luxury when it comes to health costs. And the quality of food is due to its organic and inorganic components that man desires to keep as long as possible. Food preservation is as old as the name itself and is so used today to provide great benefits (Chacón, 2006).

Food is always freshest of optimum quality at the time of its harvest or slaughter. To maintain this quality in the foods that are to be consumed later, they can be preserved with cold, heat, chemical preservatives or a combination of these methods. Cold usually means refrigeration or freezing. Heat includes many processing methods, such as pasteurization, commercial sterilization and drying. Other ways of preserving foods include adding ingredients for their conservation to process them through fermentation media. Raw foods are processed to make them easier to store besides consuming, it becomes something that may be more desirable. Strawberries can be processed, processed into frozen or dried fruits for use in cereals, or can be cooked to make jam.

Different types of food are preserved as well as processed in different ways to extend the time period in which they can be transported, displayed in a business, purchased by the consumer. The physical and chemical composition of food helps determine the type of process required for its conservation. Other factors that influence when choosing the method of conservation are: what final product is desired, type of packaging, cost and methods of distribution. The two most important factors in chemical composition that affect the way a food is preserved are water content and acidity.

The water content includes the level of moisture, but something even more important is the activity of the water. Water activity (Aw) refers to the energy state of the water in the food, whether chemical reactions will occur and / or microorganisms will grow. The content of the food - such as sugar, salt, protein or starch - "binds" to water, making it less available. Foods with lower water activity are less likely to decompose because of microorganisms and have fewer undesirable chemical changes during storage (Clayton et al., 2016).

One way to use a fruit to make it available all year round are the conservation methods by concentration of sugars, such as jams, ates, jellies, etc. A mixture of fruit and sugar that comes in semi-solid form gives rise to jams. The mixture is made under heat conditions and with the addition of pectin, depending on the type of fruit being used, acid is added to adjust the pH at which the gel is formed. The fruit can go whole, in pieces, strips or fine particles and must be dispersed evenly throughout the product. Fruit is the main ingredient of jams and gives them their own personality. The fruit defines the product formed, according to the characteristics of the fruit and determines the quality of the final product (Coronado, 2001).

The blueberry, whose scientific name is Vaccinium sp, is sweet-sour, juicy and aromatic. Blueberry has been obtained from wild plants, but in recent years is when it has begun to grow. Is the largest producer, consumer, exporter and importer of blueberries in the world and together with Canada, they account for 90% of the total production area, followed by Chile (which pioneered blueberry cultivation in the southern hemisphere), Argentina, New Zealand, Australia and South Africa.

ISSN-On line: 2414-4827

The main European producing countries are: France, Holland, Germany, Poland and Spain. The countries that demand this type of fruit are: Japan, Italy, England, Belgium and Holland. Canada is the world's largest supplier of frozen blueberries, but unlike the US, Canadian production is mostly wild-type.

Chile and Argentina offer fresh markets to the main markets located in the northern hemisphere (US, Canada and some European countries) when they are in their winter season and cannot be supplied with their local production.

Mexico, has advantages for the production of blueberries compared to its competitors. The cost of labor is relatively low compared to other producing countries in the southern hemisphere. In addition and as a great advantage is to be one of the few countries free of the fruit fly, unlike other competitors who must fumigate 100% of their shipments to the United States, with the consequent additional cost and damage in the quality of Fruit. At the national level approximately 2,000 ha of cranberry are grown. The states most representative for their production are Michoacan (600 Ha.) In addition to Jalisco (400 Ha). Virtually all of the national blueberry production goes to the export market. The main producing states in the country are: Michoacán, Jalisco, Nayarit, Hidalgo, Baja California, Veracruz, Puebla, Chihuahua. Among the many varieties used at national level are Sharpe Blue, Milenium and Biloxi.

Blueberry as a plant is a small shrub 0.2-0.4 meters high, whose scientific name is Vaccinium sp., belonging to the family Ericaceae. The flowering period should be free of the frost period. It requires slightly acidic soils with its pH between 4-5, which is maintained acidifying the water of irrigation.

Its leaves are alternate and toothed with short petioles. The Flowers: are pendulums and open solitary in the axilla of the leaves. The chalice, which is scarcely marked, has 4 or 5 obtuse teeth. The pale green spherical corolla leaves the stigma to stand out. Under the earth develops a network of superficial roots and creeping shoots, giving rise to straight, quadrangular, much branched strains, the oldest part of which is covered by a thin gray bark. It is an important plant from the ecological point of view, not only because of its fruits, but also because it protects the soil from the forests from erosion and contributes to the formation of humus (Bernal, 2010; Infoagro, 2016)

Up to two decades ago most of the honey production was destined to the international market (76.8%) (FAOSTAT, 2015); However, this trend has changed, and at present little more than half of the production is traded in the domestic market, hence the evolution of the national economy, and especially that of families, increasingly influences the Production and beekeeping marketing. For example, domestic demand for honey has undergone significant changes in recent years, its indicator, per capita consumption, went from 170 g in the 1990s to 316 g in the present, representing an increase of 85.9 %; But still below the consumption of countries such as Greece, Germany, Switzerland and the United States, where the kilogram per capita is exceeded. With regard to internal marketing of honey, the beekeeper sells little to the final consumer, and the price he receives usually depends on the number and market power of the agents involved in the process. The most extensive commercial channel is the one that includes the industry, which uses honey as an ingredient for the elaboration of foods such as cereals, yogurts, sweets and breads.

ISSN-On line: 2414-4827

Or as a raw material for the tobacco and cosmetology industry, which increasingly occupies more products such as pollen, propolis and royal jelly (Sagarpa, 2010).

With respect to the role of beekeeping as a generator of foreign exchange, and contrary to what is generally reported by some Associations and beekeepers, this has been significant for the national livestock subsector to have been significant in its contribution, was on average 12.4% of 1995 To 2009.

With respect to the role of beekeeping as a generator of foreign exchange, and contrary to what is generally reported by some Associations and beekeepers, this has been significant for the national livestock subsector to have been significant in its contribution, was on average 12.4% of 1995 To 2009.

The largest contribution was recorded in 1996, when it accounted for 27.8% of the external revenues of this subsector; these revenues increase the domestic supply of financial assets and favor the balance of payments current account balance, among other macroeconomic benefits. This contribution of foreign exchange in Mexico is higher than that registered in Argentina in 2008 (0.22%), Brazil (0.02%) and China (0.01%) (BW, 2012). On the other hand, the social importance of beekeeping in Mexico is observed, in the opportunity of production and income, and in the generation of jobs. In relation to the first, and considering that in 2008 there were 1.79 million hives in approximately 34 thousand production units or apiaries with an estimated yield of 29.1 kg per hive and sale price of $ 25 / kg, allowed an income of 1,307.7 million Of pesos, a value that represents the impulse to the local economies and, in turn, the improvement in the to 27.8% in the welfare of the families.

The second social aspect of interest is evidenced by the 2.2 million working days that beekeeping generates per year (64.7 days per apiaries) and the payment for wages of 263 million pesos. Thus, the income from sales of honey, wages and the value of the purchase of inputs, equipment and materials, are the main items of the multiplier effect of income generated by this activity on the locality or region of the country.

The economic and social importance of beekeeping is limited to its contribution of foreign exchange and the generation of jobs and income in rural areas; its contribution to GDP has declined significantly in the last two decades.

The production is destined mainly towards the collection centers, from where it is transferred to the wholesalers for its export, who determine the price in bulk; the conditions imposed on the markets have a negative effect on the dynamics of the activity. The distribution of value added to honey is inequitable and its difference

Is based on the capacity of appropriation or market power of the members of the chain. As a result, the price received by the beekeeper is comparatively low and the share of its equivalent value represents little more than a fifth of the price paid by the final consumer (Magaña et al, 2012)

Honey is a sweet and natural product, which unlike other sweeteners, has no refining processes like white cane sugars and sugar beets and does not need preservatives, often used in industrial manufacturing. Honey does not contribute fat or fiber, in relation to inorganic nutrients and vitamins their contribution is scarce.

ISSN-On line: 2414-4827

Moderate consumption of honey does not cause overabundance of sugar in the bloodstream because the necessary process of conversion of the levulose is much slower and gives enough time to the body to proceed to the elimination of sugars. That is why honey can be consumed by stabilized diabetic patients (medical diet: consuming small amounts of sugar) as it produces less damage than common sugar (Ulloa, 2010).

Among one of the numerous qualities of honey we can say that it is a powerful energizer; 330 kcal / 100 g. Suitable for athletes as it allows them to recover quickly from great efforts as well as less evidence of fatigue. It is also recommended for fatigued and elderly people (Mendizábal, 2005). The food needs of the population are varied, many of them demand new colors, aromas and flavors. For this reason innovative products such as fruit jams are not required, such as cranberry, replacing sugar with honey with a very wide commercial potential.

The product with greater sensory preference will be determined physicochemical, sensory and cost analysis.

Experimental Development

It is part of a base formulation of a suitable jam with honey instead of sugar (Table 1) for its suitability of the ingredients:

Ingredients	Quantities
Cranberry	400 g
Honey	400 g
Citric acid	2.0 g
Pectin	5.0 g
Sodium benzoate	1.0 g

Table 1 Base formulation of the product (Jam)

Several tests of jam formulations are carried out to determine the amount of fruit-honey, honey-sugar, honey-sugar-water to finally achieve a proposal of three formulations which are evaluated by a panel of untrained judges through a test Sensory preference.

Previously, the water-honey proportionality was established to know the exact proportion of Brix Degrees to be obtained in the product as a more adequate calculation of quantities to be used. Various formulations and varying amounts of fruit and honey are prepared, until the method of obtaining a marmalade with commercial characteristics is standardized.

A multiflora honey predominated with Flor de Azar (mielopolis), fruit from an orchard in the city of Atlixco, Puebla provided directly by the producer. The main raw material honey has a clear color, liquid consistency, characteristic odor, pleasant taste to the palate, with a moisture content of 18%, total carbohydrates 66% and 2% of minerals as well as vitamins according to the brand label.

Procedure for making the jam: Place the fruit in a suitable container and wash it thoroughly with soap and water, without damaging it. Weigh out pectin, citric acid, sodium benzoate and honey.

A) The fruit is selected, eliminating the chopped or infested fruit, chopping the fresh fruit into small pieces.
B) Cook the fruit to soften the pulp by moving slightly, 5 minutes later the honey is added by constantly stirring using a moderate fire, previously established the water-honey ratio for Brix grades required by the product.
C) Pectin and citric acid are added to the appropriate Brix grades (60 to 65) or to the cup and the preservative is added.

ISSN-On line: 2414-4827

D) Once the hot processing is finished, it is poured into the final package and a vacuum is generated when it is closed.
E) It is allowed to cool, labeled and stored.

Finally the finished product is carried out the physicochemical analyzes:

Humidity by the Thermobalance method, Proteins by Microkjendhal, using the universal factor (N X 6.25), Soxhlet Ethereal Extract, Calcination Ash, Nitrogen Free Extract by difference (NMX-F-132-1968). Chabacano Jam, Brix Grades for Refractometry (NMX-F-131-1982), Titration Acidity, Ph (NMX-F-317-1978), Sodium and Potassium (NOM-086-SSA1-1994). Each test was performed in triplicate, the mean and standard deviation were determined by means of a computer program (SPSS, 2014).

Sensory evaluation By the Duncan method, with a structured bimodal scale, hedonic of 9 points where 1 = I dislike at all to 9 = I like extremely and with value of 5 = neither likes nor dislikes untrained panelists, without distinguishing between sex and an age range of 18-23 years of age. In addition an estimation of product costs is made to establish the competition in the market.

Results and Disscusion

Starting from the base formulation of marmalade (Table 1) the different concentrations of fruit and honey, honey-water and some other variables were started (Table 2) until acquiring adequate consistency, as well as sensorial characteristics similar to a commercial product

% Honey	% Fruit	Modifications
40	50	10% sugar
50	50	With water 200 ml and
100	50	fresh fruit
50	50	Without water
0	50	Dried fruit
80	20	Honey syrup%
45	55	Water 300 ml.
50	50	Water 350 ml
50	50	Acid free

Table 2 Formulations obtained from fruit-honey jelly

Applying the method of multivariate factors based on the fruit-honey and as a third factor the ingredients applied in the elaboration, for some formulations very rigid gels with an approximate consistency to the caramel, other very light ones with little acidity and little formation of the gel So jamming was not achieved (Table 2).

The above are only defects of the jams in their elaboration by the fruit and how the amount of honey influences in addition to the prolonged heating or very dilated of the cooking to acquire the consistency of suitable gel. In the first case it is generated by prolonged cooking because it causes a high inversion causing rigidity, since the honey is more sensible to the heat than the common sugar. In the second case, an imbalance of the acidity and its interaction of the pectin with the different carbohydrates of the honey is generated, although also the pectin amount could have been degraded also by a prolonged cooking without forming the gel, also produce a caramel or a flaccid gel.

Of these 9 formulations, they are eliminated by their physical and sensorial aspect seven, leaving us only with option 2 and 4 which for their sensorial evaluation it was decided to take as a base the combination of both and to vary the concentrations of honey.

Once the jam formulation is adjusted, 400 g of honey and 400 g of blueberry, 250 ml water, citric acid 2 g, pectin 8 g and sodium benzoate 1 g are optimized.

ISSN-On line: 2414-4827

Once the formulations to be tested have been established, the sensorial analysis is carried out to validate the best accepted among them. Here the quantity of fruit is constant and it was modified in the amount of honey in 400, 300 and 200 g, being FA, FB and FC respectively.

It is noteworthy that sensorially does not compare sensorially with a commercial marmalade since the honey in combination with the fruit the product possesses by itself sensorial characteristics very different any marmalade commercial irrespective of the fruit that is used.

Graphic 1 Sensory evaluation of marmalade formulations

Red framed value of the same radial axis, there is significant difference (P <0.5).

In the sensory test there is a significant difference in the aroma, flavor and general appearance for the FA formulation which contains more fruit and 40% in honey, possibly due to the fruit's own taste that does not mask honey.

And among the other two formulations the untrained panelists do not distinguish some difference in aroma, general appearance and taste; the color is not different for the three formulations. Taking all the sensory characteristics, the one with the highest preference in color, odor, taste and general appearance is the FB formulation with 400 g of fruit and 300 g of honey, which is determined physicochemical analyzes in addition to costs. A marmalade made Pumpkin fruit (Telfairia occidentalis) is elaborated by comparing it sensorially with orange marmalade (Egbekum et al, 1998).

Using a bimodal structured scale of 5 points not accepting it sensorially in both color and flavor given by the consistency-color of the obtained marmalade. Also, when mango jams of different varieties and green pistachios (Kansi et al., 2003; T. Mohammadi Moghaddam et al, 2009) establish that it is important to control the quantity of fruit or seed, pectin and the heating to possess a viscosity Proper jam. In both cases they denote the obtaining of a good product with viscosity to make that sensorially a jelly is accepted using fruit or seeds.

Determination	Jam	Reference- * NMX
Protein %	00.11	0.0-0.1
Ash%	00.35	0.30 Min
Abstract	00.12	0.0-0.1
Ethereal%	96.00	36-72.
E.L.N%	03.00	18-20
Humidity %	64.00	65.00 Maximum
Degrees	00.23	0.30 Maximum
Brix%	03.30	3.0-3.8 Maximum
Acidity mg	06.67	7.07
Ph	00.06	Golden Hill Brand
K mg		1.0

Table 3 Physicochemical analysis of the best accepted jam (FB)
E.L.N: Nitrogen-free extract (---) = no data available

ISSN-On line: 2414-4827

The obtained marmalade (honey) was compared against a trademark of the same fruit (sugar), low lipid, protein and ash content, similar results are obtained by Kansi (1998) including Ph, an acid Ph is differentiated from the commercial product. A low percentage of moisture stands out for the obtained marmalade, pistachio jams, mango even Smelly-berry (Vitex mombassae), Loquat (Uapaca kirkiana), Marula plum (Sclerocarya birrea) marmalades possess values of 18-33% (Ndabikunze, 2011) this may be due to the fact that honey, water and pectin with not very high temperature can form gels with viscosity in addition to stable consistency, forming nets with fruit in addition to large amount of total carbohydrates as described Kansi, Egbekum, Mohammadi characteristic Of jam made with fruit.

The acidity of the product is similar to the Standard although Shahnawaz (2011) describe higher acidity, of course this depends on the fruit although the honey does not influence the final acidity of the product if it contributes to the consistency of the gel, as well as stability of this. Both Sodium and Potassium have nutritionally low values and would not be an adequate contribution to consumer nutrition, on the other hand comparing against the trademark marmalade are similar, these are lost during cooking to obtain the gel. Brix grades are important in marmalades so it was possible to reach 64 ° without sugar, it is important to achieve the balance between acid, pectin and sugar to give it the consistency of gel.

Ingredient	Quantity	Unit cost
Fruit (g)	200	$40.00
Honey (ml)	300	$10.00
Pectin (g)	5	$3.00
Sodium benzoate (g)	1	$2.00
Total		$55.00

Table 4 Estimation of the cost of fruit-honey marmalade

The cost of the marmalade (500g.) Is 55 pesos, this cost is not high since some commercial jams of the fruit get to be worth the 300 g. The 50 pesos. When formulating the jam was not cranberry season so the value of how much this fruit is commercially high, if it is taken into account to produce it in the harvest season and that the beekeeper to the honey has at hand the costs would be reduced considerably. The most accepted formulation was the one with less honey, which means that the cost does not rise.

Conclusions

It starts from a base formulation substituting honey for sugar to give it the viscosity and consistency of a commercial marmalade.

The honey-water ratio was established to obtain a product with the required Brix Degrees.

Formulations were developed with variations of cranberry-honey marmalade and through sensorial analysis it was selected from the best sensory acceptance by the untrained panelists.

The physicochemical analysis shows the jam has the necessary criteria to comply with the Mexican Quality Standards, with low lipid, protein and ash content. Brix grades characteristic of a marmalade, acidity and low humidity that establishes advantages in shelf life.

The cost to produce it is accessible for the production of a small company and that a beekeeper or a producer with Cranberry orchard would have the advantage of a raw material without cost.

ISSN-On line: 2414-4827

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ISSN-On line: 2414-4827

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ISSN-On line: 2414-4827

Article **ECORFAN Journal**
December 2016 Vol.2 No.3 11-18

Patents in a public research center: the case of the national institute of forestry, agricultural and livestock (INIFAP)

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Received July 04, 2016; Accepted November 30, 2016

Abstract

In this paper various documents were analyzed to determine the state of the art industry-wide patents and plant variety to compare the situation in Mexico with selected countries and the importance for a country to develop its scientific - technological apparatus and contribute to there being less technological dependence to try to bridge the gap between developed and developing countries.

Patents, Plant breeder's right, Plant Varieties, Information and State

Citation: MOCTEZUMA-LÓPEZ, Georgel, ESPINOSA-GARCÍA, José Antonio, VELÁZQUEZ-FRAGOSO, Lourdes and ROMERO-SÁNCHEZ, Martín Enrique. Patents in a public research center: the case of the national institute of forestry, agricultural and livestock (INIFAP). ECORFAN Journal-Republic of Paraguay. 2016, 2-3: 11-18.

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Introduction

The word patent derives from the Latin *patens, -entis* emerged for more than 2,500 years ago in the Greek city of Síbaris. In the year of 1427, the Venetian Republic decreed the obligation to inform the State all inventions that were taken to the practice and in the year of 1623, England sets a Statute, which established that only the patents may be granted to inventive projects (Rangel, 2009). According to the Royal Academy of the Spanish Language, the meaning of patent is being discovered, manifest (DRAE, 2015). On the other hand, at the global level, a patent is defined as a right granted by the government to an inventor or his successor in title (secondary holder).

This right allows the owner to prevent third parties making use of the technology. The owner of the patent is the only one who can take advantage of the technology that is claimed in the patent or authorizes others to deploy under the conditions that the holder attach.

Patents are granted by States for a limited period of time that currently, according to the rules of the TRIPS agreement, is twenty years. After the expiration of the patent, any person can make use of the technology without the consent of the holder. The invention enters then to the public domain (Free Encyclopedia 2015).

In Mexico, the institution responsible for granting the patent rights is the Mexican Institute of Industrial Property (IMPI, 2015). This entity points out that the patent is the certification that the Government grants, to both individuals and groups, to allow them to exploit inventions exclusively consisting of new products or processes for a non-extendable period of 20 years counted from the corresponding request (Sanchez, 2015).

On the other hand, and because the INIFAP works primarily with vegetable organisms, the instance that is responsible for granting the rights to inventions is the National Seed Inspection and Certification System (SNICS) from the Secretariat of Agriculture, Livestock, Rural Development, Fishing and Food (SAGARPA). The plant breeder's right (TO) is the term used and awarded by the SNICS that grants the rights over an innovation and gives recognition to the person or group of people responsible. To obtain a plant breeder's right, individuals need to demonstrate a process of improvement and development of a vegetal variety, of any genus and species, which must be new, different, stable and homogeneous (SNICS, 2015).

Patents allow countries to encourage the generation of inventions that subsequently would stimulate innovation.

Therefore, they are expected to boost the economy of the country by generating value, sources of employment, earning foreign currency, track exports or reduction of the output of the same through imports, a situation that in a combined way favors the trade balance of nations.

Also, patents, as a result of innovation, can increase productivity in different economic sectors. The interest in this study is the primary sector (agriculture, livestock, and forestry). In the scope of INIFAP, because of its research and innovation activities, its greater effort, regarding obtaining patents, focuses on the achievement of the Plant breeder's right that the SNICS grants. Achievement of these breeder's right gives to INIFAP the following privileges:

- To have recognition of being the owner of a plant variety.
- Breeder's rights are not portable (correspond only to the INIFAP) and imprescriptible.

ISSN-On line: 2414-4827

• To develop and exploit, in an exclusive fashion and on a temporary basis, by itself or by third parties with your consent, a plant variety, and its propagation material, to their production, reproduction, distribution or sale, as well as for the production of other plant varieties and hybrids for commercial purposes.

These rights have a period of protection of 15 years for short-cycle species (grasses, vegetables) and 18 years for perennial species (forestry, fruit vines, ornamental) and their rootstocks by the Law of Plant Varieties. These terms will have validity from the date of issue of the Plant breeder's right, and after expiration, the plant variety, use, and exploitation would pass to the public domain. The present study aims to give knowledge about the current and future importance of the development of innovative projects have for research, innovation and transfer of technology centers. This paper also discusses the importance of financial aid to support innovative research projects, its positioned in the market and its future accessibility to the public domain (mainly primary producers).

Methodology

The methodological process of the literature review consisted of three phases:

Integration of a multidisciplinary work team composed of three entities; two institutions of higher education and one of agricultural research and forestry with national coverage. Likewise, three investigators and two research assistants of the organizations referred before made contributions with their experience in various disciplines such as economics, agriculture, and livestock farming, agro-industries, strategic planning, farm management, rural development, analysis of strings, statistics, and prospective studies.

Identification and review of documents that are related to the themes of patents and achievement of Plant breeder's right. The search centralized information of the Mexican Institute of Industrial Property (IMPI) and the National Service for Seed Inspection and Certification (SNICS), as well as various educational institutions, articles, magazines and internet searches.

Classification and analysis of the information for which there was a distribution of documents between the research team. The information was classified in historic character data, conceptual framework, and statistics at global, national and INIFAP level. First, a bibliographic tab on a card was made with a summary for later and in the event of data of statistical data dump information in an Excel sheet to subsequently make the graphics. To facilitate understanding, the conceptual framework of the patents is presented in Figure 1.

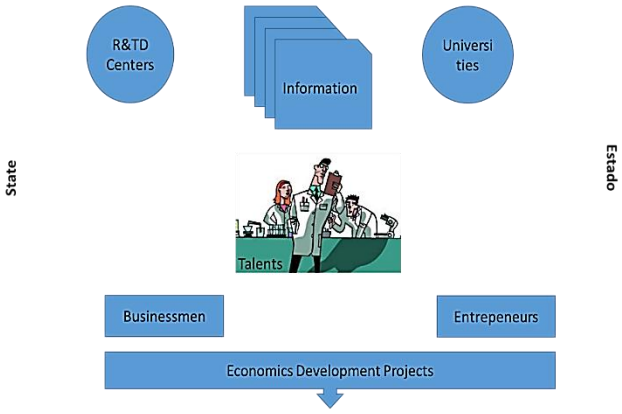

Figure 1 A theoretical model of a key factor in the patents development

The talent of the investigators is the motor shaft to make patents since ideas are generated through them for new products or processes considered would be of benefit to the society they serve.

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The information is essential in the process of patents, as it allows to know the state of the art of the big issues that act as a framework and inspiration to sustain the ideas.

The Centers for Research, Innovation and Technological Development National, and International together with the public and private educational institutions, are the spaces favorable to the exchange of ideas, experiences and methodologies to develop the experiments, prototypes, or technological innovation projects. The entrepreneurs, as well as the entrepreneurs in occasions, are linked to these institutions are devoted to generating the prototypes for being able to carry them out at the level of pilot testing and propose the results to test the market and its possible acceptance by consumers or users.

What is expected of the innovations, i.e., patents, it is to generate economic development projects in the field of their implementation. In the case of the INIFAP, the targets are the primary producers of the rural environment and preferably smallholders with few levels of use of technological packages to increase the production of their crops. All this is framed within the governmental sphere that is responsible for governing and regulating the activities for patenting; in the case of industrial and services, the entity that controls is the IMPI and in the agricultural sector, the SAGARPA is supported mainly in the registration of new plant varieties by the SNICS.

Development and Results

Global patents, based on information from the World Intellectual Property Indicators (WIPO) in its report 2014, recorded 2.6 million patents in the world and 81% of them in 2013 were conducted in five countries: China, United States of America, Japan, Republic of Korea and the European Community.

The growth in the number of patents in the previous year (2012) was 9 percent and the countries that showed the highest growth rates are shown in Table 1.

Countries	Growing rate. 2013 to 2012 difference
China	26.4
Australia	12.7
The Republic of Korea	8.3
Hong Kong	7.1
Republic Islamic Irán	5.3

Table 1 Growing rate in percentage (2013 to 2012 difference), five leading countries *Source: WIPO. 2013*

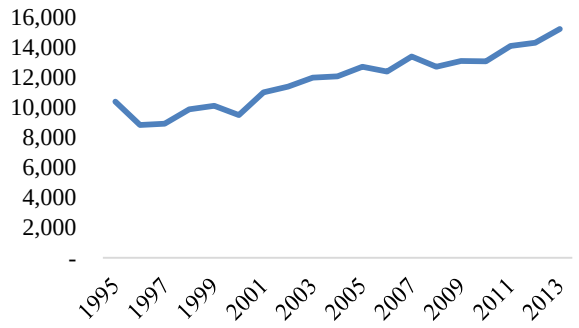
The fields of knowledge that provided the highest growth were five and between them covered 28 per cent of the applications in the patents and these areas were as shown in Table 2.

Technological fields	Growing rate from five technical areas
Measurement	21.7
Machinery and electronic devices	18.4
Information tecnologies	13.6
Digital communication	12.5
Medical technology	10.0

Table 2 Primary fields of knowledge with the highest growth rate in 2013 regard to 2012. *Source: WIPO. 2013*

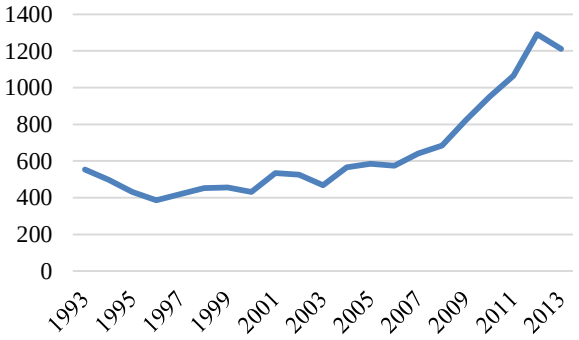
Regard to plant varieties, in the period 1995-2013, arose from 10,390 to 15,200 rights, which represented an average annual growth rate of 2.02 percent as shown in Graphic 2.

ISSN-On line: 2414-4827



Graphic 1 Plant breeder's rights of the world during the period 1995-2013.

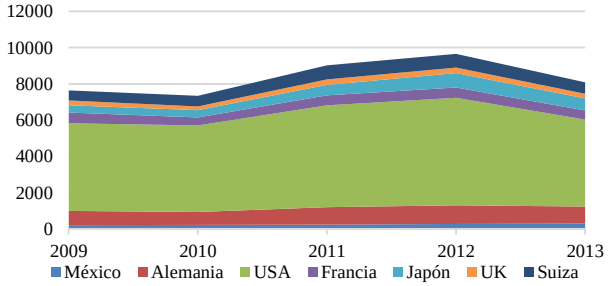
It is shown in Graphic 1 a favorable trend with falls in the years 1996, 2000, 2006, 2008 and 2010 but a slope of active type during the period indicated. In the case of Mexico, during the period 1993 to 2013 (21 years), the behavior of invention applications is shown in Graphic 2.



Graphic 2 Invention application numbers during the 1993-2013 period. *Source: IMPI. 2013*

Graphic 2 shows the number of inventions that are registered in Mexico. The graph leads to a picture where there is a little culture on patenting inventions that will lead the country to position itself as a competitive nation at the global scale. Figure 3 shows two phases, the period 1993 - 2006 in which virtually decreases to its minimum in 1996, with 386 requests and reaches 2006 virtually to their 1993 level.

However, at that moment, the second phase shows an active growth, which reached its highest level in the year 2012 with 1292 requests. As a way of comparison and with data of IMPI, Graphic 3 shows the number of patents granted per country during the period of the past five years.



Graphic 3 Patents issued per country 2009 – 2013. *Source: IMPI. 2013*

The contribution of Mexico in the world concert of patents is subtle, as noted in the first line of Figure 4; since its involvement about the global total is only 2.9 percent. The country that stands out is the United States of America with the 46.3% of the total patents granted.

In the case of Plant breeder's rights in Mexico, the information generated by the National Service for Seed Inspection and Certification from the SAGARPA was taken as reference (Table 3).

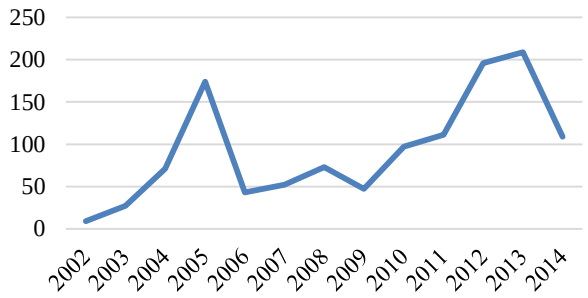
Application status	Number	Percentage
Breeder's rights issued	1,217	65.6
Certificates on record	147	7.8
Expirations	272	14.6
Desistances	73	3.9
Negative opinion	49	2.6
Waiting for approval	100	5.4
Total	1,858	100.0

Table 3 Applications presented during 1996 al 2014. *Source: SNICS*

ISSN-On line: 2414-4827

From the table above, more than half of the applications were issued as breeder's rights of various plant varieties. A little less than 15% are rights that already fulfilled its period of validity, and now they are available to all types of public. In order of importance, 247 applications, which represent 13.2% of the universe, are in the process of being qualified as Certificates on record or are in the course of being evaluated. Only 6.5% of the applications represents withdrawal and negative opinions.

The number of Plant breeder's rights and its evolution from 2002 to 2014 is shown in Graphic 4.



Graphic 4 Plant breeder's rights granted by SNICS during the period 2002 to 2014. *Source: SNICS*

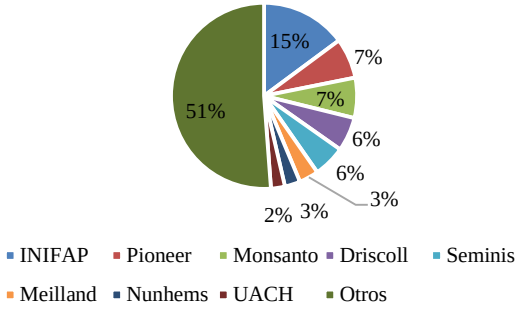
The growing trend of the registration of plant varieties in the Mexican agricultural sector is highlighted, except the falls in the years 2006, 2009 and 2014. From the rights that were awarded, the leading country that recorded before the SNICS was Mexico with 35%. The United States of America with 33% were very close. Meanwhile, the Netherlands with 17%, and France with 4% followed in order of importance respectively. Germany showed 2 % and other countries accounted the remaining 8%. Grouping by type of crops, the following are highlighted regarding percentage: agricultural 41%, ornamental 24% and fruit vegetables 13%.

To classify breeder's right by breeder, institutions and companies that stand out are the ones shown in Table 4.

Institution or Enterprise	Numbers
National Institute for Forestry, Agriculture and Livestock Research	276
Pioneer Hi-bred International	130
Seeds and Agro products Monsanto	130
Driscoll Strawberry Associates, Inc	110
Seminis Vegetables Seeds, Inc	103
Meiland International, S. A.	63
Nunhems B. V.	50
Chapingo Autonomous University	45
Other breeders	951

Table 4 Organizations that developed breeder's rights. *Source: SNICS*

From table 4. INIFAP is at the top of the list followed by six transnational corporations and the Chapingo Autonomous University appears after as another actor within the registration process of plant varieties to boost the Mexican countryside. Graphic 5 shows the participation of each of the actors involved in the patents (plant breeder's rights) of the agricultural sector.



Graphic 5 Percentage participation of research centers, private sector and academic institutions over plant breeder's rights applications. *Source: SNICS*

At the INIFAP level, the involvement in the field of patents is minimal as can be seen in Table 5.

ISSN-On line: 2414-4827

Description	2010	2011	2012	2013	2014
Plant breeder's right	37	41	43	64	10
Copyright	82	108	25	27	
Patents					2
Trademark	2	2			
Total	121	151	68	91	12

Table 5 Industrial and vegetable property: INIFAP period 2010 – 2014. *Fuente: SNICS*

According to Table 5, INIFAP has a weak contribution in the field of patents with only two registered in the period studied, and they refer to vaccines for cattle. In plant varieties, the situation is different, as mentioned earlier, INIFAP occupies a predominant place in the field of seeds.

Conclusions

Mexico, as many developing countries have a reduced participation in the global process of patents, as their presence is a little less than 3%. However, the country possesses an important piece of infrastructure coming from research centers in science, technological development, and innovation, and centers of education at higher levels, both public and private, globally recognized that in some cases placed Mexico at the level of developed countries.

Another significant strength is the body of talents from various disciplines with proven ability to develop research projects of high quality. The regulatory framework is executed with adequate management using two institutions: the Mexican Institute of Industrial Property and the National Service for Seed Inspection and Certification. The first one is dedicated to the industrial and service sector, the former to the primary sector, within the scope of the development and improvement of new varieties. A body whose head of the area is the SAGARPA.

INIFAP, as Public Research Center (ICC), has a national coverage which allows covering the four agro-ecological regions and using genetic improvement and recently through biotechnology, develops plant varieties that fundamentally are registered within the sectoral program of the SAGARPA, as strategic products. This allows INIFAP to position itself at the head of the entities that work in the development of varieties, including companies which exceed regarding budget for these activities. The plant varieties that INIFAP develops are released under an agreement of goodwill with national and international seed businesses and are put to the scope of the food producers to improve their quality and productivity which will impact on an improvement of their income and their welfare.

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ISSN-On line: 2414-4827

Article **ECORFAN Journal**
December 2016 Vol.2 No.3 19-24

Engineering process for the injection of carbon black in suspension applied directly to the polymer to obtain pigmented acrylic fiber

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Received July 24, 2016; Accepted December 19, 2016

Abstract

It is defined as a acrylic fiber a polymer consisting of linear macromolecules whose chain contains at least 85 mass% acrylonitrile structural corresponding. Some acrylic fibers are spun dry and wet spun other. Acrylic fibers, in producing fabrics and yarn can be dyed in different colors according to market needs. Dyeing is applied to the fabric by different methods. These methods include direct dyeing; yarn dyeing; Part dyeing; pigment or dye solution for the polymer; Garment dyed etc. In this research we will discuss the importance of knowing the behavior of one of the pigments used for dyeing acrylic fiber black smoke named. Produce acrylic pigmented with carbon black is indeed complicated. The lack of technology to apply specific carbon black pigment resulted in the yields obtained were not optimal in terms of color quality, operability.

Pigment, dyeability, Acrylic Fiber

Citation: ESPINOSA-SOSA, Enrique, LUGO-DEL ANGEL, Fabiola, PULIDO-BARRAGAN, Eder and CRUZ-SUSTAITA, Vianey. Engineering process for the injection of carbon black in suspension applied directly to the polymer to obtain pigmented acrylic fiber. ECORFAN Journal-Republic of Paraguay. 2016, 2-3: 19-24.

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Introduction

A polymer consisting of linear macromolecules whose chain contains at least 85% by mass of structural unit corresponding to acrylonitrile is defined as acrylic fiber.

The properties of the acrylic fibers recommend its use as an alternative of the wool in the field of the dress and the textiles for interiors. Among these properties we can mention the high voluminousness with warm touch similar to wool, its excellent resilience, its low density and its pleasant touch.

Some acrylic fibers are spun dry, with solvents and others wet spun. In solvent spinning, the polymers are dissolved in a suitable material, such as dimethylformamide, the extraction is done in hot air and solidified by evaporation of the solvent.

After spinning, the fibers are drawn hot three to ten times their original length, rippled, cut and marketed as short fiber or filament. In wet spinning the polymer is dissolved in a solvent, the extrusion is carried out in a coagulating bath, dried, undulating and collected as a filament to be voluminized or cut into fibers and packed.

Acrylonitrile is relatively inexpensive, but the solvents are expensive, so the spinning process is more expensive than the other synthetic fibers.

Wet Spinning

1. The polymer is dissolved in an organic solvent such as dimethylformamide to obtain a spinable solution containing 25 to 40% of the polymer.
2. The solution is filtered and heated to the boiling point and then extruded (similar to acetate rayon) through the die.
3. When leaving the holes in the die, the filaments pass through the spinning chamber in which a stream of hot air circulates (400 ° C), resulting in the evaporation of the solvent which solidifies the filaments.
4. The filaments are driven together and undergo a 10 to 3 stretch of their Long. Original, by means of the draw rolls.
5. If continuous filament yarns are required.

The filaments are lubricated, twisted and finally wound, if on the contrary the production is like short fiber, the filaments are mechanically crimped and cut. The spinning solution is pumped (by extrusion) through the die die (matrix die) which is submerged in a coagulant bath having a liquid which dissolves the solvent of the polymer, for its recovery.

The filaments obtained are stretched, the solvent is extracted by careful washing. They are then dried, stabilized, curled and finally cut into suitable lengths. In its absence the filaments are deposited in the form of tape.

Acrylic fibers, for use by the textile industry in the production of fabrics and threads, can usually be dyed in different colors according to the needs of the market. Manufacturers of acrylic fibers have seen the need to incorporate into the manufacturing process an intermediate step to be able to dye various colors and various types of dyes before finishing the fiber manufacturing process. Textile dyes including acid dyes, mainly used to dye wool, silk and nylon, which has a strong affinity for cellulose fibers. Unrelated dyes require the addition of chemicals, such as salts, to give them an affinity for the material to be dyed. These dyes are applied to the fibers of cellulose, wool or silk after having been treated with metal salts. The reactive dyes combine directly with the fiber resulting in excellent color setting. The first reactive dyes for cellulose fibers were introduced in 1950. At present there is a wide variety of them.

ISSN-On line: 2414-4827

Methods of dyeing

The color is applied to the fabric by different dyeing methods for the different types of fiber and in different stages of the textile production process. These methods include direct dyeing; Dyeing the threads; Piece dyeing; Pigmentation or solution for the dyeing of the polymer; Clothing dyeing etc. Of these methods of direct dyeing and dyeing of threads are the most popular.

Direct staining.

When a dye is applied directly to the fabric without the aid of a fixing agent, it is called direct dyeing. In this method the dye is either fermented (by natural dye) or chemically reduced (for synthetic dye and sulfur dyes) before it is applied.

Direct dyes, which are widely used for cotton dyeing, are water soluble and can be applied directly to the fiber of an aqueous solution. Most other types of synthetic dyes, such as vat and sulfur dyes, are also applied in this way.

Figure 1 Direct Dyeing. *Source: http://www.teonline.com/knowledge-centre/dyeing.html*

Dyeing the Threads

Dyeing of yarns is used in stock dyeing which is used to dye fibers. In this process, the staple fibers are packed in a container and then liquid dye is forced through them. Although the dye solution is pumped in large quantities, the dye cannot fully penetrate the fibers and some areas may be left untouched. However, in the following mixing and spinning processes the fibers are thoroughly blended resulting in a uniform overall color.

When the dyeing is performed after the fiber has become the yarn, it is called yarn dyeing. In this method, the dye penetrates into the fibers at the core of the yarn. There are many forms of yarn dyeing like: dyed hank, dyed package, dyeing and dyeing space.

Figure 2 Dyeing the Threads. *Source: http://www.teonline.com/knowledge-centre/dyeing.html*

Pigment dyes

Color pigments, although pigments, are not coloring in a certain sense, are widely used to color fabrics such as cotton, wool and other man-made fibers because of their excellent resistance to light. They have no affinity to the fibers and are fixed to the fabric with the help of resins. After dyeing, the fabrics are subjected to high temperatures.

ISSN-On line: 2414-4827

Pigmentation or solution for polymer dyeing

This is a method that is applied for the dyeing of synthetic fibers. The dye is added to the solution before it is extruded through the spinning nozzles for the manufacture of synthetic filaments. This gives a fiber apparently faded by the pigments that are used.

Figure 3 Solution for polymer dyeing. *Source: http://www.teonline.com/knowledge-centre/dyeing.html*

In this research we will talk about the importance of knowing the behavior of one of the pigments used for the dyeing of acrylic fiber of black carbon name. This pigment by its characteristics is applied in an intermediate step of the manufacturing process of wet spinning acrylic fiber.

Currently in Mexico exists a plant of acrylic fiber of wet spinning that produces among others pigmented fiber with black dye of smoke to satisfy the national and export market.

The market for pigmented fiber with carbon black is moderate and appreciated mainly by the domestic market. However the production runs of this product have been affected mainly by the behavior of the pigment in the process of preparation, preparation, storage and application of the same.

The objective of this research is to make known how they were solving the different problems derived from the behavior of the pigment causing interruptions in the production runs or batches of incomplete productions. On the other hand it is also objective to show the methodology used and that resulted in the substantial improvement of the behavior of the pigment once the correct actions were given to be able to carry out the runs without mishaps.

Problem Statement

Producing acrylic fiber pigmented with carbon black is indeed complicated considering that the design of the process of manufacturing acrylic fiber in the Mexico plant was created to produce unpigmented fiber. The incorporation of the infrastructure and / or equipment necessary to prepare, store and meter the solution of the carbon black pigment in the polymer prior to extrusion was done taking into account the experience gained from other similar and proven processes such as the dosage of Additives to give gloss or opacity to the acrylic fiber.

The lack of specific technology to apply carbon black pigment in the wet spinning resulted in that the obtained productions were not the optimal ones in terms of color quality, processability of the fiber, interruptions of runs, operability to dosage, quality of the Polymer blended with the pigment, etc. As a result of the need to raise the problem that prevented the production of pigmented fiber runs with good results of quality, productivity and operability.

Methodology

Given the lack of experience in the handling, use, preparation, storage and application of the black pigment of smoke, it was necessary to use the experience obtained in other similar additions as starting base.

ISSN-On line: 2414-4827

In this way, we tried to reach the best operating conditions to experience live racing tests and generate knowledge and information that allowed us to develop specifications, procedures and reengineering in facilities, equipment and vessels. Additionally as part of or complement to the methodology used, it was basically based on some tools applied in the industry such as:

- Test and Error Methodology.
- Brainstorming.
- Cause and effect analysis.

Finally, we investigated the relative technical information regarding the black carbon pigment which was very scarce since no articles or publications with results of behavior of the pigment with the acrylic polymer with wet spinning were found.

Results

The results achieved in general terms were quite satisfactory. There were very remarkable advances in some parameters and there were not very good results in other points of the product.

The achievements of the most important characteristics of acrylic fiber pigmented with carbon black as well as the carbon black solution prepared to inject the polymer prior to extrusion.

Black Smoke Preparation

The first preparations that were made had very variable results basically in two of its indicators such as humidity and filterability. This latter indicator shows the ability of the pigment to integrate with the polymer. Analyzing the causes of low filterability, several actions were taken:

- Modification of the formulation mainly in the amount of polymer as a dispersant.
- Increase in stirring speeds and grinding times in carbon black preparations
- Increasing the storage times and agitation speed in the turbomixer.

With these actions the results in filtrability improved significantly the pigment integration capacity in the polymer increased up to 100% more.

Operativity

Oerativity was essentially affected in the filtration of the solution of the carbon black preparation and in the filtration of the suspension of the polymer being both in the reduction of the life cycle of the filter elements.

Improvement of the filterability of the carbon black in the preparations resulted in an increase in the life cycle of the filter elements by up to 50% more of the typical time. Which allowed higher volumes of product per run.

Product quality

Two important quality parameters stand out from the rest in the production of pigmented acrylic fiber. These are dyeing and parching. Both are grounds for customer complaint so they were corrected as follows:

Dyeing.- To give the right tone, different dyeing tests were done with different dosing flows of the pigment to give different concentrations until finding the tone accepted by the customer. Once the flow rate of the pigment was defined with the polymer flow, the ratio of% carbon black /% polymer was established and a master flow controller was installed in the dosing to always ensure the same flow rate during the run production.

ISSN-On line: 2414-4827

During extrusion of the pigmented polymer, the fiber exhibited breakage of filaments. This defilamentation to some extent normal in the untanned fiber was increased in the runs of acrylic fiber pigmented with carbon black up to 200%.

The reduction of the fiber defilamentation was achieved with actions such as cleaning in the extrusion vats, uniformity in the speed of the extruder dosing pumps and the improvement in the filtrability of the carbon black in the preparation slurry.

Conclusions

The obtained results reflect correctness in the methodology used which allowed to be able to continue making runs of pigmented acrylic fiber for the customers who so requested. The tools used were the appropriate ones to solve the problems that were presented, analyzing the causes and the actions that were taken to achieve the results obtained in the quality and operability of the product.

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ISSN-On line: 2414-4827

Article **ECORFAN Journal**
December 2016 Vol.2 No.3 25-31

Using Petri nets in modeling automatic seeder for germination trays

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Received June 30, 2016; Accepted October 28, 2016

Abstract

This paper used Petri nets (RdP) technique in generating automation, same that was used to develop the modeling of a dosing device seed sower or seedbed pneumatic precision, this mechanism has been, for many years, object of study because it is the main element in a seeding machine places, transitions and workflow hotbed ensure that allowed duty cycle is. Petri nets are a tool that are based on systematic approach to the evolution of work to develop, transitions to meet and the graphical representation of the solution. Petri nets can be used as pre-simulation program with which the necessary model runs will be made. The representation of the model in their places and conditions that must be met for the seedbed function properly obtained.

Seeder, hotbed, Petri nets

Citation: DE ANDA-LÓPEZ, Rosa, TABAREZ-PAZ, Israel and BETANZOS-CASTILLO, Francisco. Using Petri nets in modeling automatic seeder for germination trays. ECORFAN Journal-Republic of Paraguay. 2016, 2-3: 25-31.

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† Researcher contributing first author.

Introduction

For many years, precision seeding has been an important research topic for agricultural engineering, however, most of the research and development work has dealt with seeders for agronomic open field crops. The main purpose of planting the seed is placed at a certain space and to a depth in the seedbed. Precision seeders put the seeds in the required space and provide better crop area by seed. There are two common types of precision seeders: Empty and Band.

The vacuum precision seeders have a measuring plate with metering orifices to a predetermined radius. Vacuum is applied to these holes and is provided with a machined race in a bearing plate. As the plate rotates, the vacuum applied to holes measurement allows to collect seeds of seed hopper. Seeders precision vacuum have the following advantages over mechanical seeders: improved quality of work rate less damage to seeds, better control and adjustment of maintenance and wider spectrum of applicability (Soos, et al., 1989).

A seeder to place a seed in an environment in which the seed germinates and emerges reliably. Some of the factors that can affect the separation of the plants are, the quality of the seed, soil conditions, drill design and operator skill, all play a role in determining the final position of the plant. Some of the problems identified by the selection mechanism are: may or may not select or drop a seed, you can select and drop multiple resulting seeds in small gaps between seeds (Karayel, et al., 2004). Giannini et al. (1967) He published a detailed analysis of the need for precision planting and vegetable cultivation, they discussed the development of a very successful precision seeder for lettuce that uses vacuum singling early. Compared to the standard mechanical planter, seeder vacuum uses 90% less seeds reduces the weight, reducing time, resulting in a higher yield.

Wanjura and Hudspeth (1969) they found that the efficiency of vacuum plate pattern differs vacuum pressures, lower or higher, and the speed of the fastest wheel. They also found that in a precision seeder, the seed drop height 8 mm generated a better pattern fall if handled at a height of 15 mm. They recommended that the measuring device in a planter should be located as low as possible and that the seeds must free fall to the bottom of the trench soil. Hudspeth and Wanjura (1970) They developed a seeding system using the vacuum for planting cotton. Field tests showed that the distance between plants and germination are best developed with this system compared to conventional mechanical.

Parish (1972) He developed a seeder to vertical plate, which gave good precision with Cottonseed. Kachman y Smith (1995) they compared alternative measures of precision in placing the seed for sowing, according to the theoretical space seed, they recommended using four measures to assess the uniformity of planting. Its recommended measures include multiple indexes, error rate, power quality index and the index of precision. Bracy y et. al., (1998) they showed that the variability in the spacing of the seed in a precision seeder vacuum, decreased with increasing nominal space seed, but with a seeder belt, the uniformity of spacing of the seed was not affected by the nominal separation seed. Parish y Bracy (1998) they evaluated the uniformity of turnip seed, sorted by size and ungraded its size with precision seeders band and vacuum. They assumed that a seeder vacuum should have a wider range of a band precision, since the holes of the plate only seed must be smaller than the smallest seeds in the batch.

Karayel and Özmerzi (2001) they indicate that variability in the separation of seed in a precision vacuum planter increases with increasing forward speed.

ISSN-On line: 2414-4827

They found that a feedrate 1 ms-1, It produces a better and more consistent pattern in melon seeds and cucumber, when presenting a speed between 1.5 and 2.0 ms-1.

Özmerzi, et. al. (2002) they examined the effects of different planting depths seed corn planter precision vacuum. Field tests showed that the depth of planting nominal 60 mm was optimal, according to the uniform depth and rate of germination rate. Karayel and Özmerzi (2002) they evaluated the use of a vacuum precision seeder for sowing seed melon, watermelon and cucumber. They reported that the vacuum precision planter was effective in planting these seeds.

Petri nets.

Everything around us are systems which have been classified as Event Systems Continuous and Discrete Event Systems. While a continuous system is one that changes over time steadily, a discrete system is one that changes its state at various time intervals rather than steadily (Huayna, et al., 2009). One of the tools used in modeling, simulation and analysis are Discrete Event Systems Petri nets (RdP), which have the strength to represent graphically and mathematically a model for a discrete event system.

Theorical framework

1. Automatic precision seeders

Precision seeding is defined as the seed placement, so, individually, on the floor with the necessary spacing, depending on the plants to plant. Usually, agronomists, use "dibblers" hand to achieve this precision. Planting devices equipped with measuring systems are called Single seed planters. Seeders horizontal plate with cells in the periphery were first developed precision planters (Datta, 1974).

For many years, precision seeding has been an important research topic for engineering, however, most of the research and development work has dealt with seeders for agronomic crops outdoor.

The vacuum precision seeders have a measuring plate with metering orifices to a predetermined radius. Vacuum is applied to these holes and is provided with a machined race in a bearing plate. As the plate rotates, the vacuum applied to holes measurement allows to collect seeds of seed hopper.

Seeders precision vacuum have the following advantages over mechanical seeders: improved quality of work rate less damage to seeds, better control and adjustment of maintenance and wider spectrum of applicability (Soos, et al., 1989).

A seeder to place a seed in an environment in which the seed germinates and emerges reliably. Some of the factors that can affect the separation of the plants are, the quality of the seed, soil conditions, drill design and operator skill, all play a role in determining the final position of the plant.

Some of the problems identified by the selection mechanism are: may or may not select or drop a seed, you can select and drop multiple resulting seeds in small gaps between seeds (Karayel, et al., 2004).

2. Duty cycle planters for trays

Gaytán (2006), mentioned stages of a working cycle machines sowing trays:

a) Phase separation or simulation seed individualization.
b) Loading phase or adhesion of seeds.
c) Removal phase adhering excess seeds.
d) Transport phase of the adhered or individual seeds with the tray cavities.

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e) Discharge phase or ejection of seeds in the cavities of the tray.
f) Cleaning phase of the suction holes.

3. Petri nets

Petri net is a tool for the study of systems. The theory of Petri nets can model a system using a Petri net, a mathematical representation of the system. Therefore, analysis of the Petri net can reveal important information about the structure and dynamic behavior of the modeled system. This information can then be used to evaluate the modeled system and suggest improvements or changes. Thus, the development of the theory of Petri nets is based on the application of Petri nets to modeling and system design.

Petri nets can be used as pre-simulation program with which the necessary model runs will be made. Petri nets will achieve a full understanding of the operation of the system to simulate before starting work programming and even before defining the set of attributes and model components. In other words, Petri nets allow graphically reflect the set of relationships between events and conditions that identify the system. This possibility inevitably contribute to raising the quality of the simulation model, a better match between model and simulated system. The following Figure 1 graphically shows this idea:

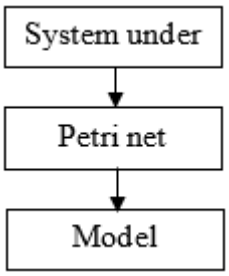

Figure 1 Integration of Petri nets and discrete simulation *(Gaytán, 2006)*

Methodology

Considering the definition of Petri net, defined by:

$$C = (P, T, A, w) \quad (1)$$

Where:

P, the places
T, transitions
$A \subseteq (P\ x\ T) \cup (T\ x\ P)$, arcs are formed of locations transitions and transitions to places.
$w: A \longrightarrow \{1,2,3, \ldots \ldots \ldots\}$, the weight function.

And defining the sequence of work for the automation of the seed or dosing cylinder must be:

1. Start.
2. Has seed tray are in the proper position, and the vacuum pressure required counts.
3. Advances to its starting position.
4. Check that is in the proper position and that there is vacuum pressure necessary.
5. Advances to the position ℓ.
6. It is in working position.
7. Release the seed removing vacuum pressure.
8. Activate vacuum pressure.
9. Turn the cylinder.
10. Check that the necessary pressure exists and is in the proper position.
11. Advances to the position ℓ.
12. In this way returns to position 7, 20 iterations to complete, as is the number of cavities of the tray.
13. In reaching its final position, the cylinder returns to its starting position to begin a new cycle of work.

Results

The structure of the RdP for the automatic dosing cylinder or roller sower arises, being raised as follows:

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$P = \{P_1, P_2, P_3, P_4, P_5, P_6, P_7\}$
$T = \{t_1, t_2, t_3, t_4, t_5, t_6, t_7\}$
$A = \{(P_1, t_1), (P_2, t_2), (P_3, t_3), (P_4, t_4), (P_5, t_5), (P_6, t_6), (P_7, t_7)\}$

$w(P_1, t_1) = 2 \quad w(t_1, P_2) = 1$
$w(P_2, t_2) = 3 \quad w(t_2, P_3) = 1$
$w(P_3, t_3) = 1 \quad w(t_3, P_4) = 1$
$w(P_4, t_4) = 2 \quad w(t_4, P_5) = 1$
$w(P_5, t_5) = 2 \quad w(t_5, P_6) = 1$
$w(P_6, t_6) = 2 \quad w(t_6, P_7) = 1$
$w(P_7, t_7) = \quad w(t_7, P_1) = 1$

Where:

Places.

$P_1 = Start$
$P_2 = Taking\ seed$
$P_3 = Starting\ position$
$P_4 = Get\ moving\ \ell$
$P_5 = Loose\ seed$
$P_6 = Tour\ hotbed$
$P_7 = Get\ moving\ \ell$

In Figure 2, the diagram is presented RdP developed. As seen in Figure 2, the onset occurs with the boot which is the position P1, immediately takes seed warehouse or store, if there seed and the necessary vacuum pressure is present. Then if you have the tray in planting position, you have the vacuum pressure necessary, then the seed is positioned at the start of the work cycle, walking distance ℓ, preset by the distance between the holes in the tray, if you are in work release position the seed, removing vacuum pressure.

Once completed this position, active pressure and the seedbed is rotated again to go the distance ℓ. Check back position and pressure, makes 20 complete cycles, as is the number of holes in the tray, to complete these 20 iterations, the device returns to its starting position to be ready for the start.

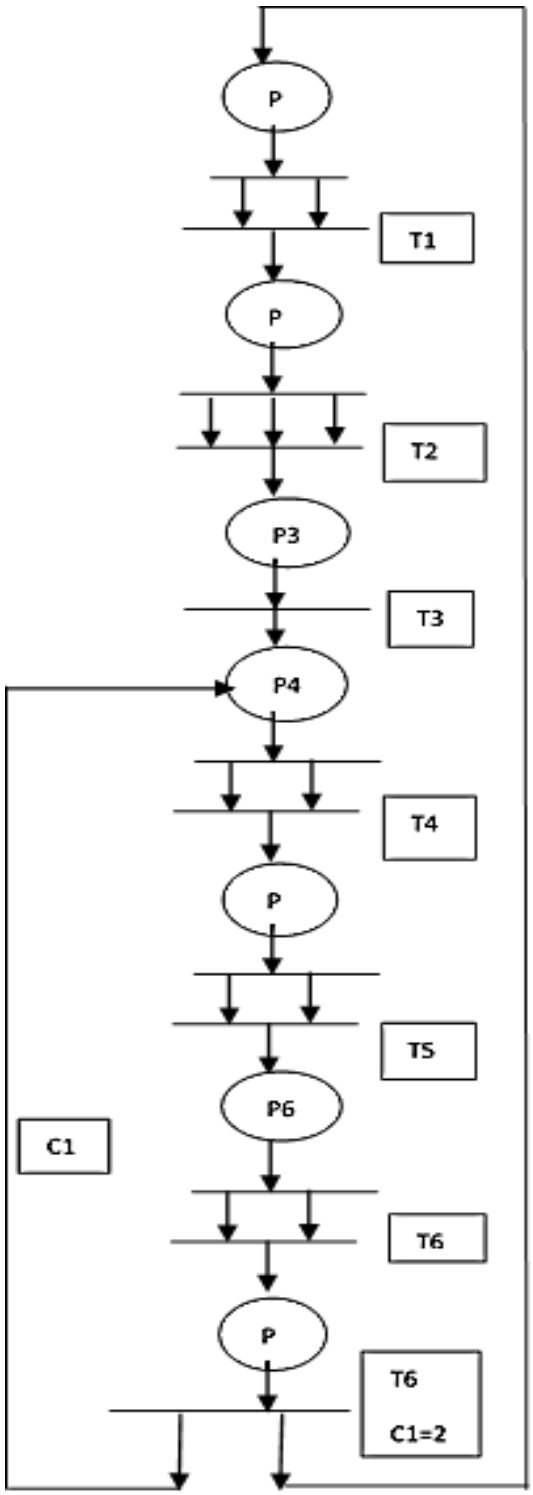

Figure 2 RdP sower of seed or cylinder

DE ANDA-LÓPEZ, Rosa, TABAREZ-PAZ, Israel and BETANZOS-CASTILLO, Francisco. Using Petri nets in modeling automatic seeder for germination trays. ECORFAN Journal-Republic of Paraguay. 2016

Acknowledgment

I thank the Faculty Development Program (PROMEP) for their support for the project.

I recognize and appreciate the valuable support given by the Technological University of South Mexico State (UTSEM), my homework, for allowing me to realize the project assigned.

Thank CONACYT for its support towards graduate study and initiate actions for this project.

Conclussions

Automating the process of planting trays significantly improve working conditions and ergonomics aspects of staff welfare by removing a set of repetitive and physically exhausting tasks. One of the major challenges in designing this type of agricultural implements is the design of roller or sower cylinder (seed), since it must ensure the performance characteristics that allow for efficient and effective planting, so is the part most relevant study.

Is necessary, our aid, a tool to represent the system components and the interaction that occurs between them, before conceiving the design that will be the final model of the system. In other words, we need to achieve an intermediate model in which to study the main aspects of the system, ie, the component elements and its static and dynamic interrelation. One of the tools used to start the modeling of seeding is to Petri nets, allowing develop the operating diagram of the automation, where the important parts of the system are presented, transitions that will make the change of location and order in which to perform.

Once having defined and performed the operation that requires that you have, you can start the mathematical modeling of the behavior of the seed, to generate the movements reflected in the study.

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- Graphic, Figures and Tables should be simple and present relevant information. Prototype;

Figure 1 Public Policy Process

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