Introduction of Italian Queens through Three Methods for the Genetic Improvement of the Apiary of the State University of Bolivar

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Abstract: *In the province of Bolívar, Cantón Guaranda, sector laguacoto II, of the State University of Bolívar, the introduction investigation of 12 queen bees of high genetic value already fertilized for the production of eggs was carried out, by three methods, (transport box, smeared in honey, dusted with flour). It lasted 60 days where 16 hives distributed in four blocks were used, with four treatments, DBCA, Duncan's test at 0.5% for the separation of means. For this, the following objectives were raised: Introduce 12 queen bees of high genetic value in the hives, Improve the productive indices of the apiary, Reduce the aggressiveness of the bees with the incorporation of new queens, Analyze the cost / benefit ratio. Of the 12 Queens, 3 survived, one of each method. When they were introduced into the hives, the first thing to be evaluated was: if they were slaughtered or not; This was done 4 days after the introduction, later with the survivors, data on the production of eggs, larvae at different ages, were taken, when comparing with the control there were no statistical differences. With this activity, it was possible to reduce the aggressiveness of the hives, being T3 (dusted with flour) the best with 106 bites per review. The T1 (transporter box) with 108 stings, the T2 treatment (smeared with honey) with 109 stings. Regarding honey production, the T3 showed better characteristics with 10 frames with honey, weighing 4.23 pounds, the control with 5 frames with an average of 3.15 each. At the beginning of the experiment, the population decreased but with the introduction of the new queens of high genetic value, the laying began and therefore the recovery of the hives, T1 (transport box), T3 (dusted with flour) with 4 Kg c / u respectively, in relation to T2 (smeared with honey) and T4 (control) with 3 Kg of workers.*

1. Introduction

Bees are introduced to the Americas on the second voyage of Christopher Columbus in 1493; the Christian brothers in 1870 make a new introduction of pure Italian bees to Ecuador; and the Ministry of Agriculture and Livestock in 1970 created the National Directorate of Agricultural Development with the particularity of disseminating beekeeping nationwide. In 1977 Ecuador joined the International Federation of Beekeeping Associations (APIMONDIA), currently it does not belong. Santillan, C. 1995.

Bees constitute a group of insects of great importance, both economically and productive, due to their participation in the pollination processes of a great variety of plants and crops.

The honey from these insects is highly desired by humans for its rich palatability, healing powers, and the products that can be taken from hives are also used in general medicine. Mendizábal, F. (2004).

Due to the aforementioned, this research is of vital importance to reduce consanguinity caused by time and mismanagement of Apiaries in the province and the country.

It is believed that by incorporating new queens of High Genetic Value to our apiaries, it will be possible to increase production, productivity, decrease inbreeding, aggressiveness, which will lead to easier handling and, above all, guarantee the sustainability of the human being on the face. from the earth.

For this research, the following objectives:
- Introduce 12 Italian queen bees of high genetic value in the hives.
- Improve production rates from the apiary.
- Reduce the aggressiveness of bees with the incorporation of new queens.
- Analyze the cost / benefit ratio.

2. Materials and Methods

This research was carried out at the State University of Bolívar, Faculty of Agricultural Sciences, Natural Resources and the Environment, located at Km 1½ via San Simón in the Beekeeping Program.

Ubicación del experimento

Provincia	Bolívar
Cantón	Guaranda
Parroquia	Veintimilla
Sector	Laguacoto II

Situación geográfica y climática

Parametros Climatologicos	Guaranda
Altitud	2640 m.s.n.m
Latitud	01°38'35''S
Longitud	79°02'01'W
Temperatura media anual °C	14.5
Temperatura máxima °C	22.5
Temperatura mínima °C	8
Precipitación media anual	900mm
Heliofania (H / L) año	930
Humedad relativa	75

Fuente: Estación meteorológica Granja Laguacoto II, 2009
Life zone

Esquema del ExperimentoTRATAMIENTO	Código	Detalle	N° DE REP	Animales (Reinas)
Caja Transportadoras (T1)	A1	4	1	4
Espolvoreadas En Miel (T2)	A2	4	1	4
Embadurnadas Con Harina (T3)	A3	4	1	4
Sin Método De Introducción (T4)	A4	4	1	4
Total De Animales				16

According to the classification of the life zones of L. Holdrige, the site corresponding to the Lower Montano (Mb) formation.

Materials

Experimental material
12 Queen Bees of High Genetic Value
4 Italian Africanized Queen Bees
16 Beehives
12 Queen Carrier Boxes

Field equipment
Beekeeping Equipment and Materials

Study Factor
Factor A:
12 queen bees of high genetic value of the Italian breed. And 4 Italian Africanized Bees. 16 queen bees

Factor B:
Methods that the queen bees were introduced to the hives.
Code B1: (queen transport box)
Code B2: (Smeared with Honey).
Code B3: (Sprinkled with sugar flour)
Code B4: Witness

Design of the Experiment

A completely randomized block design (DBCA) was applied in the research.

Esquema de (DBCA)

Fuente De Variación	Grados De Libertad
TOTAL (t . r) -1	15
TRATAMIENTO (t -1)	3
BLOQUES (r – 1)	3
Error Experimemtal (t – 1) (r -1)	9

Statistical and functional analysis

The data considered in the experiment were subjected to the following analyzes.

Analysis of variance (ADEVA)
Separation of means using the (Duncan) test at the probability of 0.5 and 0.1%.
Simple correlation and regression analysis.
Economic analysis in the cost / benefit relationship

Data to be evaluated

Adaptability
Before starting the experimental phase, the bees were orphaned 1 to 2 days in advance, by locating the queens in the honeycomb, in order to sacrifice them, in each of the experimental units, except for the control. The hives will be orphaned of their queens and therefore queens of high genetic value can be introduced.

Egg production
Once the new queens are admitted to the experimental unit of those that are accepted by the workers; We proceeded to observe at 3, 4 and 5 days, to check how is the position of the new queen, for each frame, of each experimental unit.

Larval period in its different days
Once the egg production was observed, the development and the change of phase from egg to larva were verified in the position of the new queens, in each of the experimental units.

Measure compliance
To measure aggressiveness, it was done with the help of a moving stuffed animal, the stuffed animal was placed in each hive where the queen bees were accepted, the stings that the stuffed animal received were counted, this lasted a time of 15 to 20 minutes.

Capped cells
The change from egg to pupa and / or nymph was verified, where the metamorphosis finally took place, which gave new births, either as queen, workers and drones.

Frames with honey
With the birth number that we obtained in the different experimental units, the work of the new queens, and according to the existing flowering in the fields, we verify the frames that are found with honey, and the possible harvest.

Production of honey
These data were evaluated with the honey harvest of each of the experimental units, in relation to the incorporation of the new Italian queens of high genetic value.

Population
It was carried out with the verification of the new Italian queens, their posture, the vigor of the hive with the production of more workers, drones. And therefore to know the weight of the hives to verify an approximate number of inhabitants, through the method of Farrar.

Handling the experiment
Field work began with the grouping of hives through transhumance until a group of 16 experimental units was formed, they moved from the parish of La Magdalena and La Asunción from the canton of San José de Chimbo, from (Dr. Ángel Águila).

Once the apiary was formed with the 16 experimental units, four groups of hives were formed with four hives each, the experimental units were labeled.

In 12 experimental units, prior to a random drawing, the queens were searched and then sacrificed, leaving them orphans, this was done 1 to 2 days before the introduction of queens. 12 Italian queens of high genetic value were introduced, acquired in the Abeja Centro Mundo foundation in the city of Quito.

With the hives already orphaned with 48 hours, the introduction of the new queens was carried out, on December 8, 2011, by the three methods under study that are: the methods used, transport box, smeared with honey, dusted with flour.

The first review was carried out 3 days after the introduction to observe the queens that were accepted in the different experimental units (hives) with a result of 6 accepted queen bees.

For the counting of eggs placed by the accepted and surviving queens, 8-part grids were formed on each side of the frame and then averaged and obtained the egg production of one day, this was done every day that the experimental units were visited.
The procedure was carried out for 60 days, which lasted the stage of adaptation of queens and honey harvest.

Method 1: Transport box
The introduction by conveyor box was carried out, in the same boxes in which they were transported from the place of acquisition (Centro Mundo bee), to the hive.

Method 2: Smeared with honey
In the same box where they were transported, they were bathed in honey, to then be placed in the experimental units under study, in which they were released into the hives.

Method 3: Sprinkled or dipped in sugar flour.
The introduction of queens dusted with sugar flour was carried out, in the same box that they were transported, they were dusted, the transport box was opened and then the queen of high genetic value was released, inside the hives, without its box.
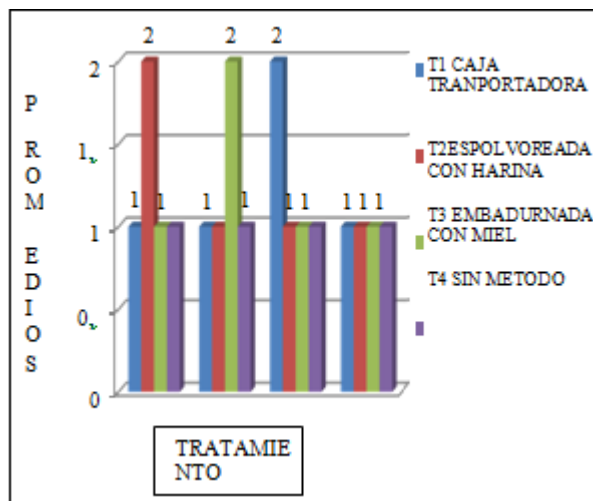
3. Results and Discussion

Adaptation

Table: Adaptation data

N° DE TRATA /REP	R1	R2	R3	R4	V	M
T1	1	1	2	1	1	3
T2	2	1	1	1	1	3
T3	1	2	1	1	1	3
T4	1	1	1	1	0	0
TOTA					3	9

Muertas. (M)
Vivas: (V)

Graph 1: Measurement of adaptation.

When observing Table and Graph N ° 1 that corresponds to the adaptation of Italian bees of high genetic value through the three methods (M1A2), (transport box), (M2A7), (smeared in honey) (M3A11), (dusted in flour) in the present investigation. This study shows that a Queen was adapted for each of the treatments under study.

The rest of the introduced queens possibly died from various causes: lack of food (flowering), individuals sacrificed them, swarms, climate, among other things flowering.

The three methods used for the introduction of queens are suitable, which reinforces Petit, H, (2004) the most accepted way to change queens is by boxes and kill the old queen on the cage that the queen is going to introduce, according to Gilles. F, (2001) no method is perfect.

Docility of the Hives

ADEVA of the variable of the compliance of the hives

FV	Gl	Sc	Cm	Fc	Duncan	
					0.5%	0.1%
Total	15	4767.75				
Tratamiento	3	714.75	238.25	0.60NS	3.34	4.86
Bloques	3	502.75	167.58	0.42NS	3.34	4.86
Error	9	3550.25	394.47			
C.V (%)	17.87		17.87			

Picture: Result of the Duncan test at 5% to check the compliance of the hives.

TRATAMIENTO	PROMEDIO	RANGO
T3	106	A
T4	123	A
T2	109	A
T1	108	A
X: 111.5 grs / NS		
C.V : % 17.87		
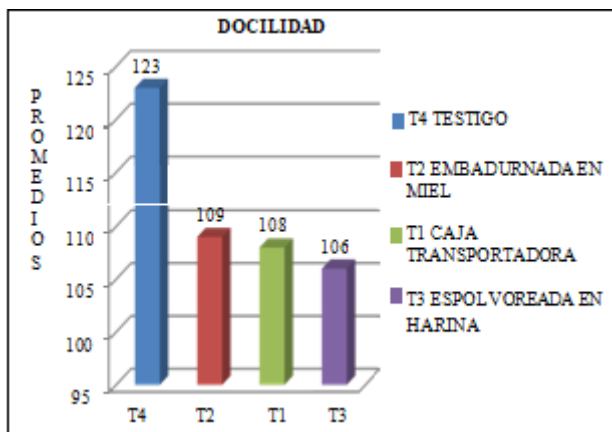
Graph 2: Measurement of compliance

When analyzing the ADEVA of docility, we can mention that there are no statistical differences between treatments and blocks, but numerically we found that in T4 (control) there is an average of 123 bites per revision. The T2 (smeared in honey) with 109 bites, T1 (transport box) with an average of 108 bites, the T3 (dusted in flour) with 106 bites per visit to the hives, that is, with the change of queens the aggressiveness of the bees. According to Valega, O. (2007) mentions that the most practical solution is to transform this large amount of brood and bees into several nuclei to which we will put a queen that transmits more desirable characters. In a short time, as aggressive bees die and docile bees are born, the hive will change temperament.

Egg Production

ADEVA of the egg production variable

Fv	Gl	Sc	Cm	Fc	Duncan	
					0.5%	0.1%
Total	15	797.94				
Tratamiento	3	23.19	7.73	0.30NS	3.34	4.86
Bloques	3	540.19	180.06	6.91**	3.34	4.86
Error	9	234.56	26.06			
C.V (%)			15.68			

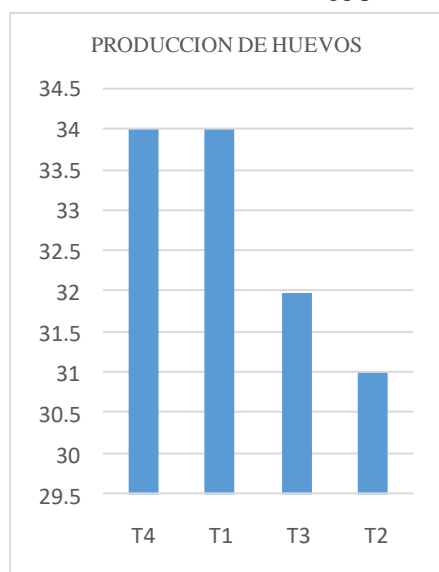Result of Duncan's test at 5% to check egg production.

Chart 3: Egg production

From Adeva egg production, with the methods carried out with the introduction of the Italian queens of high genetic value, it is observed that there are no significant differences between treatments. But there are highly significant differences between blocks due to the number of bees in each treatment, this is due to the adaptability of the new introduced queens, T4 (control) and T1 (transport box) an average of 34 eggs for every eighth of a face of the frame if we multiply it gives us a total of 544 eggs / day and per frame; It is followed by T3 (dusted in flour) with 32 eggs and finally T2 (smeared with honey) with 31 eggs per review.

When comparing with Guzmán N. (2010) the posture of the introduced queens varies by age, the younger the greater the egg production.
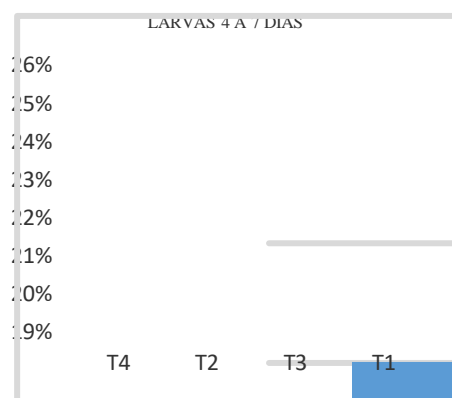
Production of Larvae From 4 To 7 Days.

ADEVA of the variable larval production from 4 to 7 days.

Fv	Gl	Sc	Cm	Fc	Duncan	
					0.5%	0.1%
Total	15	381.75				
Tratamiento	3	28.75	9.58	0.40NS	3.34	4.86
Bloques	3	135.25	45.08	1.86NS	3.34	4.86
Error	9	217.75	24.19			
C.V (%)			21.50			

Result of the Duncan test at 5% to check the production of larvae from 4 to 7 days.

TRATAMIENTO	PROMEDIO	RANGO
T4	25	A
T2	23	A
T3	22	A
T1	21	A
X:	22.75 grs / (NS)	
C.V : % 21.50		

Regarding the Table, before carrying out the analysis of variance, it was determined that the variable: larval production at the time of the review, there are non-significant differences between treatments, but numerically if there are differences in the production of larvae, T4 (control) reaches 25%, T2 (smeared in honey) with 23%, T3 (sprinkled with flour) 22%, and T1 (transport box) with 21%. As shown in the following graphic.

**Graph 4:** Larval period of 4 to 7 days

Production of Larvae from 8 to 10 Days

ADEVA of larval production from 8 to 10 days

Fv	Gl	Sc	Cm	Fc	Duncan 0.5%	0.1%
Total	15	1767.94				
Tratamiento	3	312.19	104.06	1.27NS	3.34	4.86
Bloques	3	717.19	239.06	2.91NS	3.34	4.86
Error	9	738.56	82.06			
C.V (%)			31.36%			

Result of the Duncan test at 5% to check the production of larvae from 8 to 10 days

TRATAMIENTO	PROMEDIO	RANGO
T3	26	A
T1	36	A
T2	28	A
T4	23	A
X	28.25 grs / (NS)	
C.V :	31.36%	
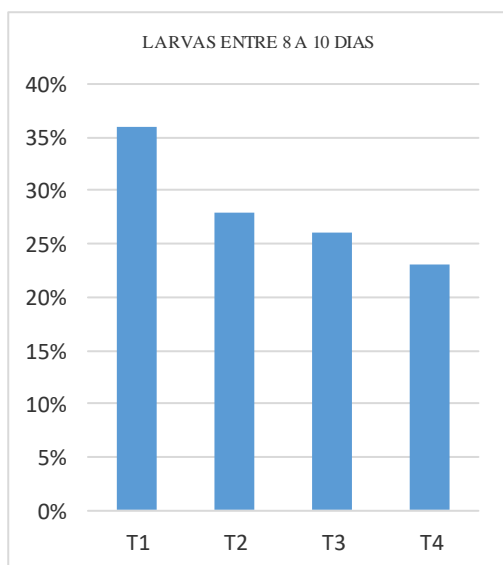
Graph 5: Larvae from 8 to 10 days.

The Table of the variable production of larvae from 8 to 10 days there are no significant differences between treatments and blocks. Numerically we find that T1 (transport box) is the highest with 36% in relation to T4 (control) which is the lowest with 23%. Treatments 2 and 3 with an average of 28 and 26% in the production of larvae that is directly related to the production of eggs.
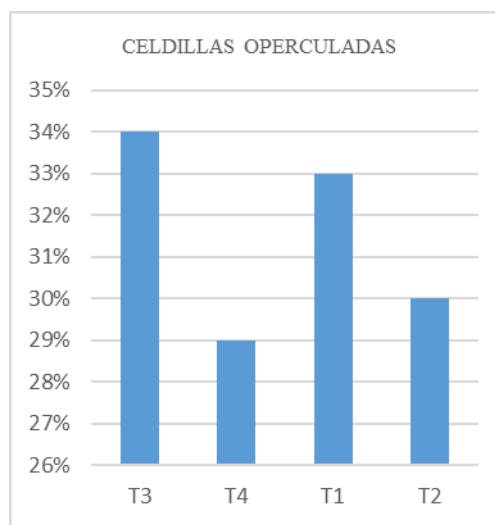
Operculated Cells

Adds capped cell count

Fv	Gl	Sc	Cm	Fc	Duncan 0.5%	0.1%
Total	15	1057.94				
Tratamiento	3	50.69	16.90	0.49NS	3.34	4.86
Bloques	3	699.69	233.23	6.82**	3.34	4.86
Error	9	307.56	34.17			
C.V (%)		18.60%				

Duncan test result at 5% to check the production of capped cells

TRATAMIENTO	PROMEDIO	RANGO
T3	34	A
T4	33	A
T1	30	A
T2	29	A
X:	31.5 grs / (NS)	
C.V : %	18.60	

Graph 6: Capped cells

When reviewing the Adeva of the variable: egg production, it is observed that there are non-significant differences between treatments, but numerically if there are, such as T3 (dusted with flour) 34%, followed by T4 (control) 29% and T1 (transport box), T2 (smeared with honey) 33 and 30%. As can be seen in Graph N ° 6.

Frames with Honey

ADEVA of frames with honey

Fv	Gl	Sc	Cm	Fc	Duncan 0.5%	0.1%
Total	15	61.44				
Tratamiento	3	56.19	18.73	55.04**	3.34	4.78
Bloques	3	2.19	0.73	2.14NS	3.34	4.78
Error	9	3.06	0.34			
C.V (%)			7.98			

Duncan test result at 5% to check the production of frames with honey

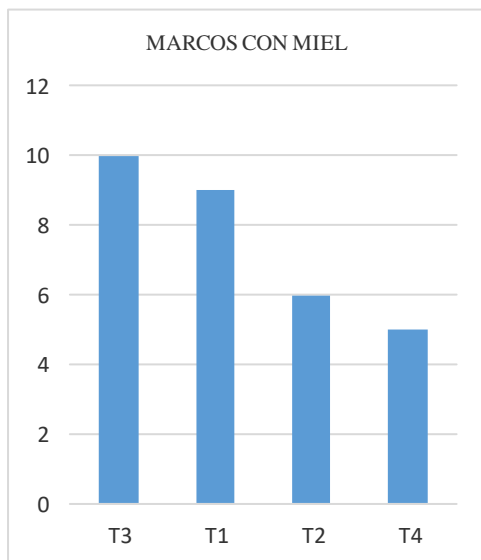| TRATAMIENTO	PROMEDIO	RANGO
T3	10	A
T1	9	B
T2	6	C
T4	5	C
X:	7.5 grs / (SIGNIFICATIVO)	
C.V : %	18.60	

Chart 7: Frames with honey

When the ADEVA analysis of the variable frames with honey is carried out, it is observed that there are highly significant differences between treatments, this apparently is influenced by the presence of Queens of high genetic value. When looking at Graph No. 7; The T3 (dusted in flour) is the best with 10 frames with honey, the T1 (transport box) with 9 frames, the T2 (smeared with honey) with six frames, lastly the T4 (control) with 5 frames.
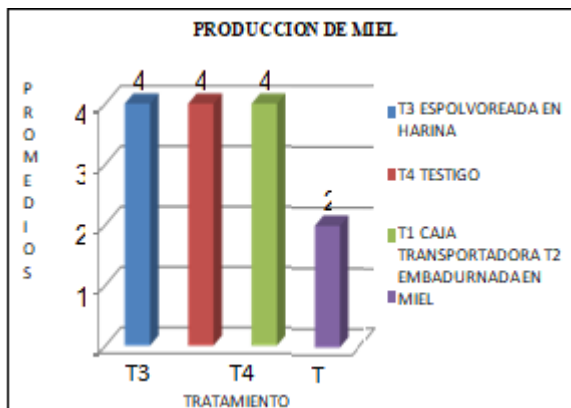
Honey Production

Honey production ADEVA

Fv	Gl	Sc	Cm	Fc	Duncan	
					0.5%	0.1%
Total	15	25.24				
Tratamiento	3	12.17	4.06	9.67**	3.34	4.86
Bloques	3	9.30	3.10	7.39**	3.34	4.86
Error	9	3.78	0.42			
C.V (%)			17.84			

5% Duncan test result to check honey production

TRATAMIENTO	PROMEDIO	RANGO
T3	4	A
T4	4	A
T1	4	A
T2	2	B
X:	3.5 GRS / (**)	
C.V : %	17.84	

Graph 8: Honey Production

With the ADEVA analysis it was determined that there are highly significant differences between the different treatments and blocks, this due to the presence of the new queen bees and the existing flowering around the apiary, the production obtained from the treatments (T3, T4, T1) is 4 pounds average for each frame harvested, the T2 with a production of 2 pounds, according to Graph N ° 8.

The present results were analyzed according to the method of Farrar (1974), who mentioned that the weight of the hive in 1 Kg of workers, the production of honey is 1 Kg, in 4 Kg of workers it should produce 8 Kg of average honey per hive
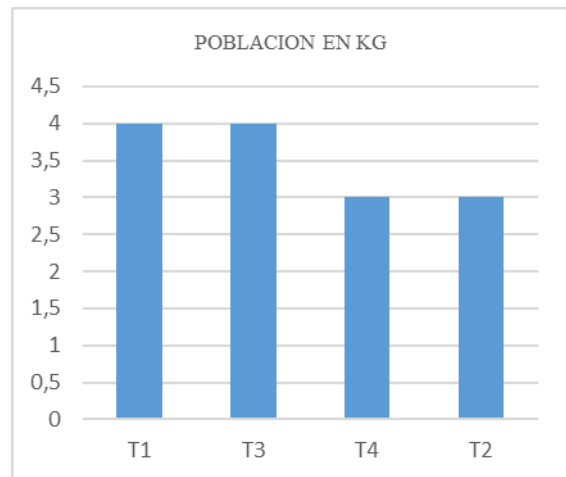
Population

ADEVA of the population

Fv	Gl	Sc	Cm	Fc	Duncan	
					0.5%	0.1%
Total	15	9.33				
Tratamiento	3	5.84	1.95	7.18**	3.34	4.86
Bloques	3	1.05	0.35	1.29NS	3.34	4.86
Error	9	2.44	0.27			
C.V (%)			14.26%			

Result of Duncan's test at 5% to check the population

TRATAMIENTO	PROMEDIO	RANGO
T1	4	A
T3	4	A
T4	3	AB
T2	3	B
X :		
C.V :	14.26%	

Graph 9: The Population

When analyzing the population variable with the ADEVA, it reflects a total relationship with the other variables such as egg production, larvae, capped cells, honey production, this means that there is a directly proportional relationship between egg production and the population. . Therefore, there are highly significant differences between treatments. With Graph N ° 9 and the analysis of variance it was shown that T1 (transport box), T3 (dusted in flour) have a better population, with an average of 4 Kg of inhabitants, compared to T4 (control), T2 (smeared with honey) with an average of 3 kg of inhabitants inside the hive. According to Farrar. C. (1974) tells us that when weighing individuals in a

hive 1Kg is equivalent to 10,000 workers, in 4 Kg there should be an average of 40,000 workers, approximately

Regression and correlation analysis

Linear Regression Analysis Chart

Variable Dependiente	N	R²	R² Aj
Adaptación	16	0.54	0.02

R² Aj= coeficiente de correlación ajustada 0,02%

Regression coefficients and associated statistics

Coeficiente	Estimación	E.E.	LI(95%)	LS(95%)
Constante	4.09	2.55	-1.95	10.13
Producción de Huevos	0.04	0.04	-0.05	0.13
Docilidad	0.02	0.02	-0.06	0.02
larvas 4-7	0.03	0.03	-0.05	0.10
larvas 8-10	0.04	0.02	-0.10	0.01
Celdillas operculadas	0.02	0.02	-0.03	0.07
Marcos con miel	0.03	0.09	-0.24	0.18
Producción de miel	0.16	0.16	-0.53	0.22
Población Kg	0.07	0.28	-0.74	0.60

According to the data obtained in the regression and correlation analysis in the previous Table, it tells us that the estimation of the variables; egg production, larvae production on different days, honey production, population docility are in the range of 0.016 to 0.02 and a constant of 4.09; What can be deduced from the introduction of Italian Queens of high genetic value, their influence is minimal compared to what was expected, and an increase of 4.09% is expected in the future, that is, genetic improvement will be slow and progressive .

Economic analysis in the cost / benefit relationship.

CONCEPTO	T1	T2	T3	T4
ABEJAS (semovientes)	83.33	83.33	83.33	0
COLMENAS (depreciación)	20	20	20	20
INDUMENTARIA (depreciación)	1.25	1.25	1.25	1.25
AHUMADOR (depreciación)	0.25	0.25	0.25	0.25
PALANCA (depreciación)	0.31	0.31	0.31	0.31
MARCOS CON CERA	4.68	4.68	4.68	4.68
MANO DE OBRA	6.87	6.87	6.87	6.87
SUMA TOTAL	116.69	116.69	116.69	33.36
COSTO DE PRODUCCION	29.17	29.17	29.17	8,34
INGRESOS				
COSECHA DE MIEL 1	53.46	37.06	35.12	54.15
COSECHA DE MIEL 2	44.42	30.43	30	45.15
TOTAL	97.88	67.49	65.12	99.30
BENEFICIO / COSTO	0,83	0,57	0,55	2,97
INGRESO	- 18,81	- 49,2	- 51,57	65,94

When analyzing the table of the economic analysis it is determined that there is a total cost of $ 116.69 dollars for the introduction of 4 Queens in each of the treatments under study except for the control that amounts to a value of $ 33.36 since it is not purchased Queens.

Regarding the analysis of the cost / benefit relationship, it is determined that in the treatments under study there is a loss

of T1 (0.83); T2 (0.57); T3 (0.55) and the control T4 is positive 2.97, that is, for every dollar invested, there is a profit of 1.97 dollars; result that is consistent with the income in this treatment that is $ 65.94

4. Discussion

For the introduction of Italian queen bees of high genetic value, the three methods should be used, transport box, smeared in honey, dusted in flour, this is based on the results obtained from this study where 6 Queens 2 of each are accepted. method; then as the days pass and we check again we find alive, one of each method that is 3 in total, this may be due to the aggressiveness of the workers and / or swarms, also due to the meteorological conditions existing in the area in those days. Regarding the aggressiveness of the hives, the T3 (dusted with flour) was the best with 106 bites per review, compared to the control T4, 123 bites.

Regarding the position, we find that T4 (control) and T1 (transport box) have an average of 34 eggs for every eighth part of one face of the frame, if we multiply it gives us a total of 544 eggs / day and per frame; it is followed by T3 (dusted in flour) with 32 eggs and finally T2 (smeared with honey) with 31 eggs per review. Reflecting on the population of the hive later, by means of Farrar's method, it was shown that T1 (transport box), T3 (dusted with flour) with 4 Kg, the same that should have approximately 40,000 individuals, in relation to T2 (smeared with honey) and T4 (control) with 3 Kg of bees, which would represent about 30,000 bees.

Regarding the production of honey obtained from the treatments (T3, T4, T1) is an average 4 pounds for each frame harvested, the T2 with a production of 2 pounds.

Finally, the introduction of Italian queens of high genetic value are very beneficial but the results are not seen in the first instance but in the later.

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