

ORIGINAL ARTICLE

ECONOMIC EVALUATION OF A BREEDING PROGRAMME FOR SETTING UP TWO HIGH PERFORMANCES BEE LINES
EVALUAREA ECONOMICA A UNUI PROGRAM DE AMELIORARE PENTRU CREAREA A DOUA LINII DE ALBINE DE INALTA PERFORMANTA

A. POPESCU *, RADOI, C.

REZUMAT

Acest studiu a avut ca scop evaluarea costurilor, veniturilor si a rezultatelor financiare aferente crearii a doua linii Apis Mellifica Carpatica, bazata pe un program special de ameliorare in cadrul unei populatii inchise. Cele doua linii au fost selectate cu mare atentie pentru populatiile de albine din doua zone ale Romaniei: Moldova de nord si Muntenia de sud. O noua tehnologie de selectie a fost elaborata pentru producerea de matci de inalta performanta, bine adaptate la conditiile de mediu si mai ales de cules. Progresul genetic se va obtine prin vnzarea de matci imperecheate selectionate, apartinind celor doua linii catre diferiti apicultori interesati sa obtina mai multe produse apicole si de calitate

Cuvinte cheie: program de ameliorare, doua linii de albine de inalta performanta, evaluare economica

ABSTRACT

This study aimed to evaluate costs, incomes and financial results related to the creation of two Apis Mellifica Carpatica lines, based on a specific Breeding Programme within a closed population. The two beelines have been carefully selected for the bee populations living in two areas of Romania: North Moldavia and South Muntenia. A new selection technology is set up in order to produce high performance queen bees, well adapted to the environmental conditions mainly to picking. Genetic gain will be get by selling the mated selected queens belonging to the two lines to various beekeepers interested to obtain more and high quality bee products.

Key words: breeding programme, two high performance bee lines, economic evaluation

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DETAILED ABSTRACT

Genetic gain in bee populations must be assured by specific Breeding Programmes according to the peculiarities of *Apis Mellifica Carpatica* in various areas. Usually a bee keeper is looking for mated selected high breeding value queens, which must be promptly provided by pilot stations where scientific breeding programmes are highly kept under control. This study aims to set up a schedule of breeding programme designed to create two new beelines supplying high value biological material for the apiaries situated in the Southern Muntenia and the Northern Moldavia. In this purpose, two pilot stations have to be founded as follows: one at Moara Vlasiei next to Bucharest and the other one at Poieni next to Iasi. A special selection chart has been used to select 100 high performance bee families of the apiaries belonging to the two pilot stations. The main selection criteria that we have used were: honey yield, queen laying capacity, bee family power, resistance to wintering, behavioural features (docility, irascibility, swarming, diligence). According to the criteria mentioned above, the best 10 bee families have been chosen per each area, of which only two of the highest performance ones have been finally retained. At the end of the two important pickings (Robinia and Lime), two progeny testing groups of 20 high performance daughters each (F1 offspring) have been created. These daughters were mated and used to set up biological units consisting of bee swarms of the same capacity with the founder queens. We were interested to study how F1 descendants have inherited the high value characters. Taking into account the picking behaviour, other two high performance bee families have been selected, of which two groups of queens – high performance daughters (at least 20 % higher performance than F1 average records) formed F2 generation, which has been tested according to the same criteria as F1. Both F1 and F2 have been comparatively studied during the 3rd year of experiments. Finally, two highest performance queens belonging to F2 have been selected and delivered to the microproduction sector (bee nurseries within the pilot stations). One of the queens is used as a mother-line and the other one like a father-line to create a new crossbred, ready to be delivered to beekeepers. Such a bee breeding programme produces 2,400 mated selected queens able to lay 1,800 eggs per 24 hours. The use of high breeding value queens could assure 40 kg average honey production/family/year and 70 g family resistance to wintering. The implementation of such a breeding programme during the period 2000-2002 needed USD 10,109, of which USD 5,396 in the 1st year, USD 2,255 in the 2nd year and USD 2,458 in the 3rd one. The main cost items were: feeding, frames, medicines, materials, labour, transportation and bee consumption. The total income obtained during the three years mentioned above was USD 19,751, of which USD 7,941 in the 1st year, USD 1,446 in the 2nd one and USD 12,364 in the last one. In the year 2000, the incomes came from marketable honey, pollen, propolis, wax, royal jelly, bee venom, queens and swarms. In the year 2001, the same bee products except swarms provided the incomes, while in the year 2002 the only marketable bee product was represented by high breeding value queens. The financial results are different from a year to another: USD 545 profit in the 1st year, USD 809 loss in the 2nd year and USD 9,906 profit in the last year. Taking into account all the three years used for the implementation of such a breeding programme, we have finally got USD 9,642 profit and 95.38 % profit rate. As a conclusion, the use of such a breeding programme can assure high performance queens, well adapted to the environmental conditions and able to increase the amount and quality of bee products. It can also assure a high profitableness within the apiaries and the pilot stations as well.

INTRODUCTION

Honey, pollen, propolis and other bee products are more and more demanded both on the domestic and the external market. This is a reason as beekeepers to look for tools to improve the genetic potential of their bee families. The most important way to increase both the amount of bee products and quality is to buy and use ready mated selected high breeding value queens. (1,2,3). But, to produce such a special queen it is necessary to set up a specific breeding programme aiming to create high performance lines well adapted to various environmental conditions and ready to supply the amount of queens required by apiarists. The main purpose of this study is to set up a schedule of breeding programme destined to establish two new bee lines, supplying high biological material for the apiaries of two important geographical areas of Romania: North Moldavia and South Muntenia. But also we proceeded to evaluate the costs, incomes and financial results closely related to the implementation of this breeding programme.

MATERIAL AND METHOD

To set up and run such a breeding programme, two pilot stations have to be founded :one at Moara Vlasiei, next to Bucharest for South Muntenia and another one at Poieni, next to Iasi, for North Moldavia. A special selection chart has been used to select 100 high performance bee families of the apiaries belonging to the pilot stations but also to various beekeepers. In this purpose, beekeepers and the Institute for Apiculture Research and Development put at our disposal up-dated evidence. All the data have been statistically processed in order to calculate the average following parameters: honey yield, queen bee laying capacity, bee family power related to the amount of existing bee babies, resistance to wintering and behavioural features such as docility, irascibility, swarming, diligence. Taking into account the level of the parameters mentioned above, the best 10 bee families have been chosen per each area, of which only two of the highest performance ones have been finally retained. As soon as the two important pickings ended (Robinia and Lime), two progeny testing groups of 20 high performance daughters each, representing F1 offspring, have been created. These daughters were mated and used to set up biological units, consisting of bee swarms of the same capacity with the founder

queens. The F1 descendants ' behaviour as well as the same parameters mentioned before has been taken into account to identify how high value characters had been inherited. According to the picking behaviour, other two high performance bee families have been chosen, of which two groups of queen bees- high performance daughters with at least 20 % higher performance than the average recorded by the tested descendants. These groups formed F2 generation, which has been tested according to the same chart as F1. During the 3rd year of experiments, both F1 and F2 generations have been comparatively studied. Finally, two high performance queens belonging to F2 generation were chosen and delivered to the microproduction sector, represented by bee nurseries within the pilot stations. One of the queens is used as a mother-line and the other one like a father-line to create a new crossbred. Primary mating inside the nurseries and then delivery in the area assures high breeding value bees, obtained of parents both self and progeny tested. The breeding of the bee families in the area is assured step by step by means of selection pressure.

The selection schedule was based on intrafamily selection, practiced into a relatively closed population. Selection was focused upon mother-line, but it was also assured a high selection pressure on father-line by the intensive growing of brood drone within the selected families. Initially, the population destined to be selected consisted of 10 high performance bee families, chosen from beekeepers's apiaries situated in the areas (North Moldova and South Muntenia) where the bees have been already tested by honey production. From those families, brought in the testing area, daughters-bee queens were grown (assuring 5 mated daughters queens per family), mated and placed into testing families of similar capacity, creating F1 generation. F1 generation was tested for one year using honey production as a main criterium, but, at the same time, following the evolution of other characters such as: prolificity, longevity, brood viability. The next year, the best individuals of each family were chosen according to the schedule mentioned before, but this time assuring a higher selection pressure upon father-line in order to stimulate and manage the creation of brood and finally to get a maximum effect of it. F2 generation have been also tested according to the same one-year testing schedule as F1. In fact, the study achieved a comparison between the evolution

of the main character – honey yield and the evolution of other characters as mentioned above for F1.

RESULTS AND DISCUSSION

The technical parameters of the bee Breeding Programme are shown in table 1. For an apiary of 120 bees size, it is needed 150 sheds for rearing and maintaining the queen bees for duration of four months. Each shed is divided into four compartments. A number of 150 nuclei/compartiment have been used to produce 2,400-mated selected queens. A number of 100 bee families have been selected per each area. The selection apiary size is 10 bee families, of which just the two best ones have been chosen. Two progeny testing groups (F1 and F2), of 20 bee daughters each were used. Finally, only two high performance queens have been selected and delivered to the nurseries in the microproduction sector. The ration number of queens per mated selected queen is 1.7. That means a number of 4,080 queen bees is needed to produce 2,400 mated selected queens. Such a queen bee is

able to lay 1,800 eggs per 24 hours. The average honey production is 40 kg/family/year and the family resistance to wintering is 70 g.

The costs, incomes and financial results related to the achievement of such a breeding programme are presented in table 2. The main cost items are: frames (300 frames for 150 sheds, 2 frames/shed/year), feeding (3,288 kg sugar and 24 kg honey syrup), medicines (Varachet, Locamicine, Micocidine, Streptomisine), materials (12 kg artificial frames, 1 Benton cage, others), labour force (2 employees), transportation (340 l oil), bee consumption (150 kg bees/shed). The total costs are expressed in USD and in the year 2000 they reached the figure USD 5,396 of which 24.2 % feeding, 44.4 % labour, 20.3 % transportation, 5.3 % frames, 3.5 % bee consumption, 1.09 % medicines and the remaining for materials.

Table 1. The Parameters of a Breeding Programme for *Apis Mellifica Carpatica* in two areas of Romania / Parametrii Programului de ameliorare la *Apis Mellifica Carpatica* pentru doua zone ale Romaniei

Parameter (Parametrul)	M.U.	Value
Apiary size (Marimea stupinei)	No. of families	120
Sheds for queens rearing (Adaposturi pentru cresterea matcilor)	No. of sheds	150, the length of use 4 months
Compartments (Compartimente)	No/shed	4 , the length of use 4 months
Nuclei needed for queens obtaining (150 x 4)/(Nuclee necesare pentru obtinerea matcilor)	No	600, the length of use 4 months
Mated selected queens (Matci imperecheate selectionate) (600x4)	No	2,400
Selected bee families per area (Familii de albine selectae per zona)	No	100
Selection apiary size /area (Marimea stupinei de selectie)	No. of families	10
The best bee families chosen (Cele mai bune familii selectate)	No	2
Progeny Testing Groups - F1 and F2 (Numar grupuri pentru selectia descendintilor)	No	2
Group size (Marimea grupului)	No. of daughters	20
High performance queens delivered to microproduction (Matci de performanta inalta livrate in microproductie)	No	2
No. of queens needed to obtain 2,400 mated selected queens (Numarul de matci necesare pentru obtinerea a 2400 matci imperecheate si selectionate)	No	4,080
Queen's average prolificity (Prolificitatea medie a matcii)	Eggs/24 h	1,800
Average minimum honey yield (Productia medie minima de miere)	kg/bee family	40
Resistance to wintering (Rezistenta la iernat)	g/family	70

Table 2. Costs related to the Breeding Programme / Cheltuieli aferente Programului de ameliorare USD

Cost Item (Element de cheltuieli)	2000	2001	2002
Total costs, of which: Cheltuieli totale, d.c.:	5,396	2,255	2,458
-Frames (Rame)	286	104	113
-Feeding (Hranire)	1,311	477	520
-Medicines (Medicamente)	59	22	24
-Materials (Materiale)	56	20	22
-Labour (Forta de munca)	2,400	1,165	1,270
-Transportation (Transport)	1,096	399	435
-Bee consumption (Consumul de albina)	188	68	74

In the year 2001, the total costs were by 58 % lower than in the previous year, due to a reduced number of activities and amount of used materials. The costs in the year 2002 are higher due to the high number of activities.

Income level is different from a year to another and depends mainly on the amount and quality of

marketable bee products (table 3). Of course, it also depends on market price. In the year 2002, the highest recorded income was USD 12,364, an income 2.08 times higher than the one registered in the year 2000 (table 4).

Table 3. Marketable Products/bee family assured by the Breeding Programme / Produse comercializabile asigurate de Programul de ameliorare

Income source Sursa de venit	M.U.	2000 *	2001**	2002***
Honey (Miere)	Kg	20	40	-
Pollen (Polen)	Kg	6	7	-
Propolis	Kg	0.3	0.36	-
Wax (Ceara)	Kg	0.6	0.72	-
Royal jelly (Laptisor de matca)	Kg	0.5	0.6	-
Bee venom (Venin)	Kg	0.006	0.006	-
Queens (Matci)	No	1,000	75	2,400
Swarms (Roiuri)	No	20	-	-

*The products were supplied by 40 % of the bee families.

** The products were supplied only by 10 bee families.

***The only marketable product in the 3rd year is "the mated selected queen".

The financial results are different from a year to another. In the first year, the programme led to USD 545 profit. In the second year, an USD 809 loss was

recorded, but then in the third year the profit has reached the highest level: USD 9,906 and the highest profit rate - 403 % as well

Table 4. Financial results assured by the Breeding Programme / Rezultate financiare asigurate de Programul de ameliorare USD

Indicator	2000	2001	2002
Total costs (Cheltuieli totale)	5,396	2,255	2,458
Total incomes, of which: Venituri totale , din care:	5,941	1,446	12,364
-Bee products (Produse apicole)	2,870	1,218	-
-Mated selected queens (Matci imperecheate selectionate)	2,785	228	12,364
-Swarms (Roiuri)	286	-	-
Financial results (Rezultate financiare)	+545	-809	+9,906
Profit/Loss rate (Rata profitului/Pierderilor)	+10.10	-35.87	+403.00

CONCLUSION

-A breeding programme for setting up two high breeding value queens has been established for North Moldavia and South Muntenia.

-A number of 2,400 high value queens could be provided to assure genetic gain in the beekeepers apiaries.

-The breeding programme costs is totalizing USD 10,109 for the three years of experiments, but incomes are more than sufficient to cover them. The total income for the three years was estimated at USD 19,751 of which marketable queens value represents 77.85%, that is USD 15,377.

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Popescu Agatha*, orrespondence author, agatha_popescu@hotmail.com
Radoi Cecilia

*Faculty of Management, University of Agricultural Sciences and Veterinary Medicine, Bucharest, Romania
59 Marasti, sector 1, Zip code 71331,
Phone: (40) .21.224.25.76/232, Fax: (40) .21.224.28.15