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SELECTION SCHEME TO INCREASE MEAT RABBIT PRODUCTION: ORGANIZATION SYSTEM, GENETIC EVALUATION AND PRELIMINARY RESULTS

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SUMMARY- A selection scheme to increase meat rabbit production was organized 1996 by A.I.A. (Italian Animal Breeders Association) and A.N.C.I. (National Rabbit Breeders Association). The organization of selection scheme was planned considering rabbit's particular characteristics (short generation intervals, high prolificy). Basic principles of the scheme were: identification of all animals of the farm and data elaboration directly in the farm. Specific software to collect data and update archives were developed. Data were collected directly by breeders associated to National Rabbit Breeders Association creating a data-set with information of all animals. The genetic evaluation is at the moment carried on a single trait, litter weight at 70 days of age, using a 'BLUP-AM' technology to get an index within farm as the prediction of the additive genetic value for every animal. Progeny of the best indexed individuals are selected to be the next generation's parents, in order to improve both farm's genetic level and phenotypic expression of the considered trait. In the next future a genetic evaluation within farm for other traits (number of animals born alive, number of animals weaned, number of nipples) will be performed using a multiple trait approach for a simultaneous genetic evaluation of all traits. The genetic evaluations for years 1996 and 1997 showed a monthly positive genetic trend of litter weight at 70 days.

Key words: Selection scheme, litter weight, genetic evaluation

INTRODUCTION

Meat rabbit production is of major importance in Italy. According Colin and Lebas (1996), Italian rabbit meat production is estimated at 300.000 tons. Meat rabbit production in Italy is normally based on the massive use of hybrid animals which have to be bought. On the other hand, there is an increasing number of rabbit farmers breeding a hybrid base population on which a large amount of crossing is made. The selection of best breeders for future generations has been made, up to now, by selecting for phenotipical traits without considering genetic merit. The aim of this work is to present a selection scheme prepared by A.N.C.I. (National Rabbit Breeders Association) and A.I.A. (Italian Animal Breeders Association). The selection scheme has been developed considering rabbit's performances (short generation interval, high prolificy) and is justified by the institutional duty of ANCI, i.e. genetic merit improvement of recorded animals. Rabbit breeders farms use similar management, based on cyclic weekly operations. Artificial insemination, but very different situations arise when the source of breeders is considered. Three different kinds of breeding policies can be found in Italian rabbit farms: 1) farms using hybrid reproductors from commercial enterprises; 2) farms using breeders coming from several crossing carried on by the farmers itself and 3) small farms with breeds such as New Zealand White or Californian or crossing of the two purebreds. Such farmers's behaviour in using different sources of breeders can be explained by both the managerial choice of farmer and significant limitations in farmer's selective work due to the great amount of data to collect and the short generation interval.

Use for selection is limited because farmers have not a immediate elaboration of data. A data collection method was studied and applied to build up efficient genealogic and productive files for genetic evaluation of meat rabbits.

The goal of selection scheme has been stated in defining an operative model to collect data for reproductive (number born alive, number weaned, number weighed at 70 days), productive (individual

weight, litter weight) and morphological (number of nipples) traits to be used for intra-farm genetic evaluation for meat rabbits. Number of nipples has been collected from the beginning of 1998.

The aim of the selection scheme was to allow the farmer to manage all phases of collection and to elaborate productive and reproductive data, up to the production of genetic indexes in his farm, and to have all males and females identified to obtain more accurate prediction of their breeding values.

The base unit of selection scheme is the single farm, working as a selection nucleus under ANCI's control. In the nucleus raw data are monthly collected, archives are updated, breeding values calculated and ANCI's central archives are updated. During last two years genetic indexes have been estimated for trait "litter weight at 70 days of age". For this trait, an heritability of .20 was used: such value was similar to those reported by Randi and Scossiroli (1980), while Baselga *et al.* (1982) found, on meat rabbit, a value of .34. For similar traits like weight of the individual at 70 days, Lukefahr (1992) found a value of .16. Male effect was estimated as uncorrelated random effect with a proportion on total variance of .05. This proportion is similar to that found from Rosati (1996) on sheep for lamb weight at weaning trait.

MATERIALS AND METHODS

The selection scheme was applied in the beginning on two farms associated with ANCI, while in 1998 six farms are currently working in the scheme. The farms have not started the selection scheme at the same time.

The first step of the scheme was to identify all animals of the farm. Such identification was achieved by applying an ear identification mark to adult animals and a little mark, indicating box number, for young animals. In addition, boxes were divided for different categories (birth box, male box, replacement/gestation box, finishing box) and for each category a progressive number was assigned. Animals or box number allow any identification for all animals of the farm, included young animals.

The second step was to collect and productive and reproductive data. Particularly, the following events and traits were collected and registered: mating (male id, doe id, mating date), birth giving (date, doe id, number of born, born alive and dead), nipples count, weaning (date weaning, number weaned, doe or box id), weighing (date, box id, individual weight, litter weight, sex of weighed animal), moving of animals from a box to another (date, initial box, destination box, number moved), replacement identification (box id, animal id), management of entering (animal id, enter date, sex, birthdate, sire id, dam id, box id) and exiting identified animals (animal id, exit date, exit cause). An electronic scale directly connected with farmer's personal computer was used for weighing operation.

Data are collected by the farmer which inputs data directly in the personal computer. Data collection, which could appear as the more difficult activity was at the end very easy and the only attention requested to the farmer is to assure box number and animal identification number. In addition, data collection program is able to produce a printed output with a summary of several informations on animals' performances that can help the management of the farm. The program has

been developed to reduce as much as possible farmer's time of work and to make it as friendly as possible, allowing at the same time the correctness of collected data. Data collection activity allows, for each farm, to build up and update an historical file with all genealogical and productive informations for male and female breeders.

The last step of the selection scheme is the genetic evaluation of all animals for traits collected in the farm and recorded in informatic support. Table 1 shows the collected traits for each record of the historical file.

Such data are collected for primiparous does only. Due to the short generation interval of rabbits time from the first parity to the use of the indexes for selection on the same doe allow to select for an animal at second - third parity or later.

It was decided to select for the trait "litter weight at 70 days". The trait is a good measure of doe's attitude to produce heavier litters. Litter instead of single progeny's weight was chosen since the farmer is interested in meat production that depends on the whole litter weight. Data collection and

structure include in the model the father of litter as uncorrelated random effect. The genetic additive effect was studied on does. A *BLUP-Animal Model* was used to predict breeding values. The model used for genetic evaluation of animals was :

Tab. 1

Doe id
Sire of doe id
Dam of doe id
Adoption doe
Doe's age at first parity
Doe birth date
Male id (i.e, mate of doe)
Doe first parity date
Number of born alive
Number of total born
Weaning date
Number weaned
Litter weigth
Weighing date
Sex of born
Number weighed
Weight of individual born

$$Y = X\beta + Z u + Is + e$$

where:
Y = litter weight at 70 days
X = incidence matrix for fixed effects
Z = incidence matrix for random effects
β = fixed effects vector (month by year of first parity, age at first parity, expressed in days, as quadratic covariate)
u = random effects (direct: animal effect)
I = diagonal matrix
s = mate of doe
e = random error

For direct animal additive genetic effect a value of .20 of heritability was used, while mate effect was considered to have an influence of .05 on total variance.
The prediction of breeding values was performed using MTDFREML program (Boldman and Van Vleck, 1991).

Breeding values were used to rank the best does and males. Replacement for female and male line were taken from the best litters of the best does to avoid that choice from a limited number of males could cause inbreeding effects on productive and reproductive performances.

RESULTS

Main controlled traits averages are reported in table 2 for farms 2 and 3 in years 1996 and 1997 respectively.

Regarding genetic trend in the considered farms, a comparison between average yearly estimated breeding value for all does and for selected does only was made for years 1996 and 1997. The results are shown in table 3.

Table 2.

	Year 1996		Year 1997	
	Farm # 2	Farm #3	Farm # 2	Farm # 3
Controlled primiparous does (number)	283	46	360	103
Controlled males (number)	14	6	18	10
Weighed animals (number)	1525	269	1940	614
Weighed litters (number)	283	46	360	103
Average litter size (number animals)	5.38	5.85	5.40	5.93
Average individual weight at 70 days (grams)	1946	2041	2051	2039
Average litter size at 70 days (grams)	10469	11939	11075	12091
A.D.G. from 1 to 70 days (grams/day)	27.8	29.15	29.3	29.13

Tab. 3

	Farm # 2		Farm # 3	
Year	Average index for all females	Average index for selected females	Average index for all females	Average index for selected females
1996	2.85	111	407.57	859
1997	34.37	97.89	124.96	899.45

DISCUSSION

An increasing number of controlled breeders can be outlined from table 2, confirming the growing interest of rabbit farmers in this selection program. In farm # 2 during years 1996 and 1997, 283 and 360 litters weights respectively were controlled from first parity does, and 1525 and 1940 animals were weighed. Litter average size did not increase passing from 1996 to 1997, neverthless average litter size increased from 10469 to 11075 grams and ADG increased form 27.8 to 29.3 grams/day respectively.

In farm # 3 during years 1996 and 1997, 46 and 103 litter weights respectively were controlled from first parity does, with 269 and 614 animals weighed. Litter average size increased from 5.85 to 5.92 passing from 1996 to 1997, and average litter size increased from 11939 to 12091 grams with ADG from 29.15 to 29.13 grams/day.

The genetic trend for the trait was calculated by year of birth. A comparison between average does index and average index of selected does can be found in tab. 3. A slight decrease in genetic trend can be pointed out for selected does in farm # 2 (111 vs 97.89 grams for years 1996 and 1997 respectively), while for farm # 3 an increasing trend can be found (859 and 899.45 resp. for years 1996 and 1997). Genetic trend was influenced by the larger size of animals partecipating to selection scheme in 1997 respect to 1996.

CONCLUSIONS

Economic goals are of major interest: the farmer can achieve a higher litter weight at 70 days, obtaining a higher income from slaughter animals and the important source for income from the possibility to sell breeders with genetic indexes for both sexes. Thus, the advantages are: replacement

based on the best animals for genetic merit, higher average genetic merit of farm's animals, increasing production, increasing market value of indexed breeders of both sexes.

This project gives the chance to have intra-farm genetic indexes for the trait "litter weight at 70 days of age". But several other productive traits, such as number of born, number of weaned, teats number etc. are also collected then are available for a genetic evaluation. In the future, animals will be also indexed for the other traits as well as for litter weight. *BLUP - Multiple Trait Animal Model* is the technique used for estimating genetic indexes for all considered traits. Further development will be to exchange breeders among farms to allow to estimate coefficients to compare genetic indexes from different farms.

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