Multi-facetted research in rabbits: a model to develop a healthy and safe production in respect with animal welfare

Fact Sheet

Project Information

Grant agreement ID: 848

Funded under
IC-COST

Project website

Overall budget
€ 0

EU contribution
€ 0

Start date
7 June 2000

End date
6 June 2005

Coordinated by
N/A
Belgium

Objective

A. BACKGROUND
a) The rabbit: a European speciality
The rabbit (Oryctolagus cuniculus) originates from the Iberic peninsula and has already a long tradition as meat producer in Europe. The total World production of rabbit meat is estimated at 1 600,000 tons of meat (Colin & Lebas, 1995) and nearly 70% of it is produced in European countries. The European production of rabbits nearly equals that of sheep but is larger than goats or turkey production. Despite this production level, the EU still has a deficit (10-15%) and significant imports from e.g. China take place (25,000 tons/year) (Alvarez de la Puente, 1996). Taste and quality (residues) of these frozen imports have been contested several times already. Since the sixties, commercial units have progressively replaced off the traditional
rabbit production in small units with 1 to 10 reproducing does. These farms have mainly between 250 and 1,000 does but are still family farms. Actually, they account for more than 50% of the total production. The production level has significantly increased from about 20 fatteners per doe/year to nearly 50 per year. However, differences between farms are very large (production levels between 25 and 60 fatteners/doe/year). This can mainly be ascribed to the weak disease control, reproduction problems and high density of animals in a closed environment. Commercial rabbit production has potential because it produces highly nutritious meat, which is relatively higher in protein and polyunsaturated fatty acids, and lower in fat, cholesterol and sodium than common red meats and poultry. This lean meat (<10% fat) is therefore adapted to the current demands of the consumer.

The rabbit is considered famous in terms of its reproduction capacities. The reproduction cycle is short and the prolificacy high. In intensive rabbit production units, females produce every 45-50 days a litter with 8-10 young. Because of the induced ovulation, a large flexibility in reproduction is observed. However, both for artificial insemination and in view of oestrus synchronisation, use of hormone treatments is widespread. These intensive methods can be criticised from the side of animal welfare and the consumers' perception.

The actual cage housing, individual for reproduction stock or in small groups for growing animals, is discussed in terms of animal welfare. In many countries as Denmark, The Netherlands, Norway, Germany, United Kingdom and Switzerland, the actual housing system in commercial units is presently contested. An alternative housing system has to be developed with respect to the behaviour characteristics of this species, but up to now no real alternatives have been proposed because scientific knowledge remains very scarce.

Furthermore, rabbit production is still characterised by its high losses. Already in the nest, a mortality rate of 10-15% is observed in farms. These losses are mainly ascribed to two different pathologies. The first one, which is badly explored, has a metabolic cause and depends on the high reproduction capacity of the doe (prolificacy, milk production) and leads to a high mortality of sucklings when the does are especially exhausted. The second one is sustained by several other infection diseases (colibacillosis, pasteurellosis) of mainly digestive pathology which provokes a high mortality in fatteners (10-50%). Caecal impaction and more recently enterocolitis (Coudert & Lebas, 1997) have led to an important decrease of the production (15-20% in some periods). The pathogenic agent is not yet identified and besides the contagious character, several indications of a multi-factorial disease are found. Actually, uncontrolled treatments are widespread to minimise losses due to infectious diseases. A better disease control is of vital importance for an economical rabbit meat production in countries adhering to the COST Action.

Especially the enterocolitis syndrome has demonstrated that the actual production techniques are doubtful. Multidisciplinary approaches in consideration with pathology and dietary-enteritis relationships have to lead to a better prophylactic programme. Genetic improvement, artificial insemination and housing systems also have to be implemented in such a programme.
b) The need of an integrated horizontal collaboration
With the development of the commercial rabbit meat production, research projects have been established in several European countries. However, the research teams are mainly focused on one area (nutrition, pathology, genetics or reproduction). Although, efforts were made to co-ordinate the research, today, research on rabbit has still a mainly fragmented, short term and discontinuous character.
The World Rabbit Science Association (WRSA) organises a World Congress with about 300-400 participants every 4 years. This scientific organisation encourages the collaboration between teams and several workgroups were established in the past (harmonisation in meat criteria and in digestibility, welfare). However, because of the lack of WRSA funds to support these workgroups, several of these efforts were not successful. But they have been at the basis of a demand for national or international research funding.
Rabbit scientists are convinced of the need to collaborate (EGRAN and IRRG, Gidenne 1999) and recently 2 European groups were partly funded by the EC (ERAFE concerted action: Fair 3 PL96 1651 and Genetic Resources Resgen CT95-60). The first one is devoted to harmonise the methodology concerning feed evaluation, while the second aims to characterise, to evaluate and to conserve the European rabbit genetic resources. Both groups consist of a limited number of countries and laboratories and they collaborate on a very specific topic. A third group (not funded) has recently started up (Chairman Prof. Boiti, Perugia) to collaborate on reproduction topics and efforts are made by the WRSA to establish a welfare group.
On the topic of pathology and disease prevention in the rabbit, only very recently (October 6) a preliminary meeting was held in Berlin with researchers involved in rabbit pathology from 7 countries (Germany, The Netherlands, Belgium, France, Italy, Spain and Portugal).
The proposed integrated project intends to co-ordinate, to support and to intensify the above mentioned research efforts between different disciplines. This COST Action would in fact consolidate the work of the workgroups held during the WRSA congresses and their wish for a close co-operation between teams and disciplines. In the past, scientists from different countries involved in rabbit research have shown their positive intentions to work together, which will favour this Action. Except for collaborations within the same discipline (Perez et al. 1995; Boiti, 1998; Gidenne, 1999; Theau-Clement et al., 1998), there also has been a multidisciplinary approach in rabbit research (e.g. Peeters et al., 1995; Coureaud et al. 1997; Licois & Gidenne, 1999; Marounek et al., 1999). However, the limited possibilities in terms of experimental equipment, personnel and financial possibilities restrict a real integrated approach of this production. Therefore, the Action also intends to leverage increased financial possibilities in the different participating countries.

B. OBJECTIVES AND ADVANTAGES
The main objective of the present proposal is to create a multidisciplinary model to improve the fundamental and applied knowledge about rabbits in commercial rabbitries. It would propose production and prevention methods at the European level, in order to guarantee a regular, secure and economical production. Natural,
sustainable methods respecting animal welfare and delivering a quality product adapted to the actual wishes of the European consumer would be used. Expected applications will be the deployment of a scientifically based prevention program, the development or improvement of existing strains free from highly pathogenic agents and adapted breeding methods which take into account the interactions between nutritional status, health and physical convenience of the does. Furthermore, it intends to develop housing systems and standards respectful of the social character of this species. These objectives are of vital importance for the survival of the commercial production of this animal. The specific objectives correspond with the following milestones to be achieved after 5 years:
- Identification of main pathogenic agents, introduction of serologic tests and vaccines.
- Detection of specific antibodies against the main pathogenic agents using ELISA tests and elution electrophoresis.
- Evaluation of contamination risks and methods to improve the quality of existing productive rabbit strains.
- Increased knowledge in dietary factors involved in rabbit enteritis problems.
- Optimalization of an exclusively vegetable diet for rabbits.
- The introduction of guidelines for welfare and housing of rabbits.
- Establishment of a reproduction system with respect to the physiologic balance and animal welfare.
- Evaluation of rabbit meat quality and changes due to feeding and genetic selection.
- The production of rabbit meat free from residues and pathogens such as Salmonella.

At the present time, rabbit research is mainly concentrated in Europe with France, Italy and Spain as leading countries. In several other countries, however, research teams are involved in projects concerning this species. Creating an efficient synergy between these existing groups should be for the benefit of COST countries and allow keeping the European leadership in this production. Furthermore, several laboratories have a lot of experience with pathology, reproduction or ethology of other animal species. Although they are actually not involved in rabbit research, the proposed COST Action will contribute to disseminate their knowledge and expertise for the benefit of rabbit meat production. The Action will support the creation, improvement and consolidation of existing and new networks and partnerships between complementary research groups and scientists from different COST countries. It aims at the collaboration of laboratories specialised in rabbit pathology, ethology, meat quality or reproduction but, also with laboratories with proven expertise in these fields but with other animals. Especially, in view of the education and training of young scientists, not only the exchange between the different laboratories involved will be encouraged but also short missions to labs
with known expertise on a specialised topic. These short term scientific missions mainly aim to learn specific methods used for disease control or analytical methods and behaviour methodology. Secondly, they aim to standardise methodology and to co-ordinate the research efforts between the participating labs.

Today, production techniques are being developed with the unique goal to increase the production level. The Action intends to develop a sustainable production in line with the growing consumer concern (e.g. dioxin, BSE, antibiotic residues). However, the current trend to ban all dietary antibiotic treatments for animal production in Europe, would probably lead to an increase of animal disease problems. For this reason, the proposed Action intends to develop vaccination and prophylaxis programs, a protected environment and the creation of specific pathogen free strains. It is a real international and multi-disciplinary collaboration, for which each individual country could not provide the necessary expertise, finance and personnel.

Furthermore, this proposal also addresses problems related to animal welfare and rearing methods. The Action aims to develop a rabbit meat production in agreement with the suggestions done by the Council of Europe (European Permanent Committee for Animal Protection) related to farm breeding of this species. However, specific recommendations for this production are not yet available. Therefore, the Action will enable to obtain scientific arguments useful for future guidelines and legislation.

Summarising, the goal of this COST action is to develop and to co-ordinate the divergent actions in the different countries in order to improve the production methods and the animal welfare in commercial rabbit meat production. The final goal of this proposal is to favour this production to the benefits of the consumer and the European economy.

C. Scientific programme

The proposed COST Action intends a dynamic interaction of various research and industrial teams having complementary expertise and interests in the fields of animal disease control, prophylaxis, nutrition, reproduction-physiology, behavioural studies and engineering. The scientific programme will respect the COST rules, and the co-operation will take the form of a concerted action, i.e. the co-ordination of existing or proposed research projects funded nationally. Therefore, the scientific programme will be based on the research and the developments made by the participating teams in this Action. The proposed Action will focus on rabbits, but contacts and common meetings with appropriate ongoing Actions would be welcome and useful, to exchange information and take profit of their expertise. A collaboration with COST Action 97 (Pathogenic micro-organisms in poultry and eggs) will be organised and links with Actions 99 (Food consumption and composition data) and 839 (Immunosuppressive viral diseases in poultry) will be established.

To meet the main objective and milestones of this COST Action, five working groups will be created:

Working Group 1: Reproduction and genetics

WG 1 will study the problems related to the specific reproduction characteristics of
this species. Artificial insemination is widespread in commercial rabbit production. This implies the use of hormonal oestrus synchronisation and a systematic use of a hormonal induced ovulation. Alternative methods, based on appropriate environmental stimuli, which avoid the use of exogenous hormones have to be tested and optimised (Link with WG 2). This implies the study of their effects on the hypothalamo-pituitary-adrenal axis and, consequently, on oestrus and ovulation. Adapted reproduction rhythms or selection of strains better adapted to the actual and future standards have to be verified. Interactions between genetics and reproductive capacities have to be taken into consideration.

Working Group 2: Housing and welfare
WG 2 will focus on behavioural studies in actual, alternative housing systems and in free range keeping systems. Infrared video technique, operand conditioning techniques, comparative behaviour and production data are means to achieve standards for production systems. Physiological stress parameters will be measured using plasma glucocorticoid level, stress protein gene expression and glutathion peroxidase activity.

The use of electronic engineering techniques will be applied to develop an alternative group housing for reproducing animals. This implies:
- Observation studies with infra-red video technique
- Development of individual electronic nestbox recognition systems
- Testing of pilot alternative housing systems
- Maternal behaviour studies of the doe versus her litter and the nestbox
- Behaviour studies of new-borns and of the pheromones involved.
- Use of choice test pens with different keeping details

Furthermore, the production criteria will be measured and an active interaction with the pathology workgroup will be established.

Working Group 3: Pathology and prophylaxy: identification and vaccination studies
WG 3 will focus on the identification and characterisation of "emerging" pathologies with special attention to enterocolitis. The elaboration of rapid diagnostic methods is intended. Alternatives for the use of antibiotics have to be developed (vaccines) and tested in field conditions. Epidemiological studies concerning the main infectious pathologies (colibacillosis, pasteurellosis, staphyloccocosis) have to be executed. An overall prophylaxis scheme has to be drawn up in order to limit the use of therapeutical interventions. Early mortality of young and the interaction with the health status of the mother will be studied. In close collaboration with WG 4, the interactions between nutrition and pathology will be studied intensively around weaning age. Finally, initial rabbit reproduction stock has to be cleaned up until a status near to specific pathogen free (SPF) animals.

Working Group 4: Nutrition: relationship nutrition - pathology
Mortality and morbidity of fattening rabbit originated mainly from digestive pathology. However, the specific digestive physiology of the rabbit requires a comprehensive approach of the rabbit digestion including digestion through enzymes of the host or by the caecal flora (Gidenne, 1997). Microbial activity, transit time, digestibility and biological performance will be studied according to dietary factors (such as fibre...
supply or natural additives) or health status of the animals. Controlled infection experiments have to elucidate the relationship between dietary factors and pathology, and more particularly the way in which nutrition could improve the resistance against digestive pathology (Licois and Gidenne, 1999). Especially in the transition period, which is around weaning time, special attention will be given to this relationship (see relationship with WG 3). Because of the large effect of the doe on the post-natal pre-weaning mortality, the interaction between the nutrition of the doe and that of her young will be studied. The goal will be to improve our knowledge in the nutrition of the young rabbit and therefore to improve its resistance to digestive pathology. Furthermore, methods to measure the health status of rabbits, such as the validation of an index to evaluate more precisely the sanitary risk of a treatment, need to be improved.

Working Group 5: Meat quality and safety
Rabbits, just like other herbivores, need to be fed without the use of animal sources. The use of oil-rich feedstuffs, however, has severe consequences on the quality of the pellets as well as on the carcass and meat quality (turn-over). Effects of the use of oils or oil-rich feedstuffs on physico-chemical and sensory characteristics as well as on the preservation of rabbit meat will be intensively studied in WG 5. The consequences of the current genetic selection to increased growth rate on meat quality characteristics will be included.

The workgroup will also partially focus on the residue problem in relation with the disease prevention programmes and will take into account the possible risks of the turnover from feedstuffs to the meat (relationship with WG 3 and 4). Finally, the identification and prevalence of potentially pathogen micro-organism (e.g. Salmonella) in rabbit meat and methods to avoid contamination will be studied in WG 5. However, these two last items related to meat safety will be restricted to specific problems for rabbit meat production, referring for general meat safety to other programs (e.g. COST Action 97).

The interdisciplinary approach and the most important links between the 5 workgroups are presented in the following scheme, while the methods and goals are summarised on the next page.

Dissemination of results
Results of the Action will be disseminated through the preparation of proceedings of the Workshops and joint scientific publications in international journals. Applied results and guidelines will be presented in Technical Reports for publication in applied journals in the field or for distribution by Government bodies.
A website, in which the Action is presented and the agenda and calls are mentioned, will be organised. Publications and/or guidelines will be available on this site. Links with the site of the World Rabbit Science Association (http://www.rabbit-science.com) and the official COST site (http://www.netmaniacs.com/cost) will be organised.

D. Organisation and timetable
Organisation structure
The organisation and co-ordination of the Action will be undertaken by a Management Committee, assisted by the secretariat of COST, in accordance with the common procedures for COST initiatives. The Management Committee will be composed of co-ordinators from each workgroup, representing national interests and official scientific representatives of each country participating in the Action. The first meeting, with the representatives of the countries participating in the Action, will be primarily devoted to nominate the different co-ordinators and subco-ordinators and to develop the research programmes. Each workgroup will consist of one co-ordinator, one subco-ordinator and, if necessary, several project managers. Besides their co-ordination task, the co-ordinator and subco-ordinator will promote the set-up of joint-research, encourage the mobility of researchers between institutes involved in the Action and promote short term scientific missions. Based on the presentations of the different participants, they will regularly provide progress reports to the Management Committee.

The Management Committee will assess and report the progress to the partners during the planning and working meetings. They will promote and check the co-operation of data exchange between the Working groups. They will also ensure that links are established between the other COST Actions working on complementary topics. They will provide an annual research report in which the Action is evaluated and the adaptations of the work programme are identified.

Timetable:
The total duration of the Action is estimated to be 5 years.
The start-up meeting at the beginning of COST will have as main objectives:
- To clarify precisely the general organisation and responsibility of co-ordinators and participants and the links with the Secretariat of COST.
- To establish the overall 5 year work programme and objectives
- The organisation and the settlement of the objectives of the first WG meetings
The Group meetings will enable to learn about the existing research, possibilities and future projects. The participants will present the research advances and/or obstacles. Links and movements between laboratories will be established, and a harmonisation of the methodology discussed.
Group meetings will be held in one of the participating countries or in conjunction with a congress in the field of a Work group.

E. Economic dimension
The following 10 COST countries have actively participated in the preparation or otherwise indicated their interest in the present proposal: Austria, Belgium, France, Germany, Greece, Hungary, Italy, Portugal, Spain and The Netherlands. With the following other countries (experts) positive contacts were made: Czech Republic, Denmark, Poland, Slovenia and Turkey.
At the present time, (12.08.99) 24 Institutes from 10 different COST countries have already expressed their interest in the proposed Action by a written agreement (see
In each of the participating countries, 2-5 persons are expected to devote their work to projects related to this COST Action. The present proposal will respect the COST rules, and the co-operation will take the form of a concerted action, i.e. the co-ordination of existing or proposed research projects funded nationally. Therefore, this COST Action will be based on the actual research and development done in the individual participating institutes. On the basis of national estimates provided by the representatives of these countries and taking into account the co-ordination costs to be covered over the COST budget of the European Commission, the overall cost of the activities to be carried out under the Action has been estimated, in 1999 prices, at a minimum of 30 MEURO.

The total economic impact includes:
- Senior scientists and staffs: 36 x EURO 60.000 = EURO 2.2 million
- Junior scientists including PhD students: 24 x EURO 40.000 = EURO 1.0 million
- Technicians: 24 x EURO 35.000 = EURO 0.8 million
- Laboratory equipment and consumables EURO 1.2 million
- Overhead costs EURO 0.5 million

EURO 5.7 million
TOTAL over 5 years EURO 28.5 million
Coordination costs (COST)- EURO 0.6 million
Total economic dimension, approximately EURO 30 million.

Programme(s)

Topic(s)

Coordinator

N/A

Last update: 5 March 2003
Record number: 69377

Permalink: https://cordis.europa.eu/project/id/848

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