

## SMALL-SCALE RABBIT MEAT PRODUCTION IN THE WESTERN HEMISPHERE : BACK TO BASICS ?

LUKEFAHR S.D.

Department of Animal & Wildlife Sciences, Campus Box 156, Texas A&M University-KINGSVILLE 78363, USA

**ABSTRACT :** In the Western Hemisphere, in countries where the demand for rabbit meat is low, and where intensive livestock production systems are common (e.g., commercial broiler, swine, and cattle production), it may not be appropriate for rabbit scientists to recommend commercial rabbit production. Commercial-scale rabbit operations might only be justified, at best, when located in proximity to processing plants and/or to large cities where there is a strong tradition of rabbit meat consumption. The high cost of producing rabbits translates into high consumer prices, which tends to limit sales to that of a luxury or specialty commodity. An alternative, "back to basics" approach is to recommend small-scale or backyard rabbit enterprises. There are a number of clear advantages to this approach. Such a down-scaled unit could represent a more favorable "economy of scale" of production. Generally, feed costs could be reduced through the utilization of homegrown or less expensive feedstuffs, labor could be shared among

family members, and less expensive housing and equipment would be needed. Although productivity may decline, economic returns may exceed costs at a higher rate than for commercial operations. In addition to family consumption, local meat sales could become more competitive because of lower costs of processing and transportation, especially if there are no rabbit meat inspection laws. Small-scale rabbit production would also support integrative practices (e.g., gardening and vermiculture) and potential local markets for rabbit meat and by-products (e.g., tanned skins and rabbit manure as "organic fertilizer"), which could supplement farm revenue. In addition, there are opportunities to develop poor communities through small-scale rabbit projects. This paper proposes a "cottage industry" model of rabbit micro-enterprise development to secure food and economic stability for rural-based small farm families throughout the Western Hemisphere, and to improve the image of rabbit production as a viable activity.

**RESUME : La production du lapin de chair en occident, en unités de petite taille : retour aux vrais objectifs ?**

Dans les pays occidentaux où la demande en lapin de chair est faible et où les productions animales en systèmes intensifs sont courantes (telles que poulets, porcs ou bovins) il se pourrait qu'il ne soit pas souhaitable que les scientifiques recommandent le développement d'une production commerciale de lapins. Une telle production ne pourrait se justifier, au mieux, que si elle est implantée à proximité des abattoirs et/ou de grandes villes où existe une forte tradition de consommation de viande de lapin. Le coût élevé de production du lapin, qui se traduit par un coût élevé pour le consommateur, réduit les ventes à celles d'un produit de luxe ou d'une spécialité. Le "retour aux sources" proposé est une approche alternative qui recommande l'élevage à petite échelle ou simplement familial des lapins. Cette option a des avantages nombreux et évidents. Ces petites unités peuvent réduire leur coût de production : souvent la famille peut produire l'aliment ou l'obtenir à bas

prix, partager le travail entre tous ses membres, et fournir logement et équipement au moindre coût. Si la productivité risque de diminuer, en revanche le taux de retour sur investissement sera supérieur à celui des productions commerciales. En plus d'une consommation familiale assurée, la vente sur place devient très compétitive (spécialement quand il n'y a pas de règlement concernant la viande de lapin) car elle nécessite peu de mise en oeuvre et peu de transport. La production du lapin à petite échelle encourage des pratiques telles que le jardinage ou la lombriculture et les marchés locaux potentiels pour le lapin ou ses sous-produits (peaux tannées ou crottes comme fertilisant organique) qui augmente les revenus des fermiers. De plus, ces projets d'élevage à petite échelle sont susceptibles de contribuer au développement des communautés les plus pauvres. Ce papier propose un modèle de développement d'entreprise familiale qui assure nourriture et revenu stable aux petits fermiers occidentaux, et fait de l'élevage du lapin une activité viable.

### INTRODUCTION

The U.S. commercial meat rabbit industry was first developed in the 1920-30's in southern California. During World War II, rabbit raising was very popular because of national meat rationing (excluding rabbit meat) to support the military and the low cost of producing rabbit meat. In the 1950's, the infantile industry was instrumental in the development of formulated and pelleted diets, wire cages and metal feeders, specialized breeds (New Zealand White and Californian), and management programs (MCNITT *et al.*, 1996). A strong market also existed that catered to consumers who were largely of southern European descent. In the 1950-60's, the U.S. commercial rabbit

production system ("technical package") was imported to Europe, notably in France, Italy, and Spain where commercial production is now mostly concentrated (LEBAS *et al.*, 1997). More recent is the development of commercial rabbit farming in Central and South American and Caribbean countries.

Prior to this introduction in Europe, traditional production was aptly described by PARKIN (1973) as a "cottage industry". This system typically involved rearing only a few breeding rabbits in rustic hutches, and feeding hand-cut forages, weeds, limited grains, and farm "wastes" (NIEDZWIADK, 1988). In Hungary and Poland, and in other northern European countries, the rabbit meat industry continues to be dominated by small-scale, subsistence producers who maintain a maximum of 50

**(1) Note of the Editor-in-Chief :** This special new section "POSITION PAPERS" is devoted to papers in which the authors expressed their position about evolution of rabbit production or biology under light of one part of the published literature and of their up-to-now-unpublished own experience. Clearly, such papers don't represent the official position of the World Rabbit Science Association, but may stimulate debates and scientific discussions. Scientifically well argued answers are eligible for publication in this Journal.

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breeding does (NIEDZWIADK, 1988; LEBAS *et al.*, 1997). In Poland, consumers usually drive to a farm to buy rabbit meat directly from the farmer; rabbit meat is not widely available in stores (M. BRZOZOWSKI, personal communication). Because of favorable "economy of scale" conditions, small-scale rabbit production is a popular micro-enterprise activity. The objective of this paper is to examine the rationale for promoting large commercial rabbit industries in countries in the Western Hemisphere where economic conditions are not particularly favorable with respect to profitability.

### STATUS OF RABBIT MEAT INDUSTRIALIZATION

#### A poor prognosis.

In the U.S., rabbit enthusiasts have struggled for years to develop an economically viable meat rabbit industry. Commercial fryer production continues to be a marginally profitable business, relative to other livestock species, despite the rabbit's astounding biological efficiency. Most rabbit producers operate a part-time business consisting of less than 50 breeding does (MCNITT *et al.*, 1996). Reliable estimates of the number of meat rabbit producers and per capita consumption do not exist. In general, markets tend to be unstable. The strongest markets are those that sell rabbit meat to major buyers in the east (New York City and Boston) and the west (Los Angeles) where there are large ethnic populations of southern European origin with a tradition of consuming rabbit meat (CHEEKE, 1988). The largest rabbit meat processing plant is located in the midwest (Rogers, Arkansas) as a strategic central distribution point to markets on the east and west coasts. In the U.S., large and successful commercial enterprises are usually located in proximity to major processing plants, which are few in number. Similarly, in Canada and in Central and South American and Caribbean countries, commercial production enterprises generally are established only near major cities where there is a high demand by consumers of European descent. Based largely on feed sales, the estimated breeding doe population in the world is 64.2 million. Of these, 1.9% are found in Central America, 4.0% in North America, and 2.7% in South America (COLIN and LEBAS, 1996). These figures reflect the limited popularity of commercial rabbit production in the Western Hemisphere. Nonetheless, the latter survey report also indicated that the five largest producing countries (in declining order) in the Western Hemisphere are the U.S., Mexico, Brazil, Venezuela, and Columbia.

Another factor limiting industrial development is negligible government support to encourage the growth of the rabbit industry. The United States Department of

Agriculture (USDA) does not recognize rabbits as a livestock species. In 1960, the only USDA Rabbit Research Station was closed soon after the director retired. Concurrently, urbanization in southern California essentially squeezed out the rabbit industry due to escalating land prices and strict health regulations. From the late 1970's to the early 1990's, there was a resurgence of interest and activity in the rabbit industry, which coincided with the establishment of the Rabbit Research Center at Oregon State University. This program was terminated for reasons that included the retirement of one of its directors, insufficient state and national (USDA) funding support, and discouraging industry trends (P.R. CHEEKE, personal communication). Some of the negative trends included unstable markets, rabbit meat imports, the VHD outbreak in Mexico in 1989, the so-called "Easter Bunny Syndrome", and the animal rights movement in which rabbit producers were and continue to be a popular target (e.g., H.A.R.E. - Humans Against Rabbit Exploitation). To date, there are only a few rabbit specialists employed at universities or in industry in the U.S.

In the U.S., it has been extremely difficult to make inroads in the meat marketplace (despite the nutritional qualities and health attributes of rabbit meat) because of the highly competitive nature of business practices. The poultry and swine industries continue to expand and integrate to minimize production costs, which limits the prospect of rabbit meat becoming a competitive commodity. Moreover, consumer demand for meat is at the saturation point (ACKER and CUNNINGHAM, 1998), which stimulates even greater competition among the well organized beef, pork, and poultry industries. The USDA (1997), reported 1995 production costs for market beef of \$1.28/kg, broiler chickens and turkeys of \$0.75/kg and \$0.90/kg, and hogs of \$0.90/kg, compared to fryer rabbits of \$2.11/kg (based on \$330 per metric ton of feed, 10 hours of labor per doe per year, and economic figures given in MCNITT *et al.*, 1996). These figures account for labor costs. The high \$2.11/kg figure for rabbits explains the high retail costs in food stores and in "white table cloth" restaurants, and to the categorization of rabbit meat as a luxury product. In addition, many potential major businesses demand contracts for large and regular meat supplies which many rabbit processors simply cannot meet. The irregularity of the fryer supply is a major problem due to seasonality of the rabbits. Yet another limiting factor has been lack of organization among producers, limited cooperation between producers and processors, and poor business relations between processors and buyers of rabbit meat. Notwithstanding this, one still often hears about a novice rabbit producer with grandiose schemes (e.g., 100,000 doe operation, feed mill, processing plant, and guaranteed store contracts) who soon goes bankrupt due

to lack of either basic rabbit management or business skills. The commercial rabbit enterprise has been described as an 18 month business : 6 months going into the business, six months actually in the business, and six months getting out of the business (N.M. PATTON, personal communication)!

In Canada and in Central and South American and Caribbean countries, commercial rabbit production has not generally been economically successful. A possible exception is commercial production of Angora rabbits which appears to be well established in the southern region of South America (KAPPEL, 1985 ; COLIN and LEBAS, 1995). CHEEKE (1985), VIANA (1988) and COLIN (1995) reported widespread interest and expected growth of intensive meat rabbit production in Brazil. Promotion of the business as a "grand lucros" opportunity for entrepreneurs was extolled. At the present time, the commercial industry has all but collapsed because the limited demand was heavily outstripped by the supply (J. BENTO and A. MOURA, personal communications). In Mexico, OWEN (1981) and COLIN (1994) referred to an elaborate national rabbit program (based in Irapuato with regional centers) with the mission of research, training, and breeding stock distribution. This program had only limited success, but it is now in the process of reactivation (C. BECERRIL, personal communication). In Guatemala, the potential for a commercial rabbit industry only in Guatemala City has been documented (DAVILA, 1984). In Haiti, commercial rabbit production was referred to by KENTOR (1990) as a "fragmented industry". However, in Cuba, PONCE DE LEON (1996) reported that the rabbit industry yields 500 million metric tons of rabbit meat annually. This figure is low compared to European production levels, but the industry appears to be thriving, despite the outbreak of Viral Hemorrhagic Disease (VHD) in 1993. The VHD threat is a serious matter for commercial producers in all countries in the Western Hemisphere where rabbit meat imports from China continue to infiltrate the market. Based on limited reports, personal communications, and the author's consultancy experiences, it would appear that rabbit markets are largely limited to the vicinity of major cities (e.g., Buenos Aires, Caracas, Lima, Mexico City, Rio de Janeiro, Santo Domingo, and Toronto) in countries where the tradition of rabbit meat consumption is strongest because of European ethnicity. Rabbit scientists and government officials should exercise caution when determining the potential for commercial meat production in their own country. Based on a regional track record of limited success, the industry must be well organized and supported by rabbit research programs (and to some extent by government) in order to promote rabbit meat to consumers, address research



Children in the Dominican Republic enjoying delicious and nutritious rabbit meat.

needs, protect producers from VHD, ban imports, prevent business monopolies, and balance supply and demand.

#### LOCAL MARKET, "COTTAGE INDUSTRY" DEVELOPMENT

##### Back to basics.

In the opinion of the author, in the Western Hemisphere, the rabbit should be primarily viewed as a backyard species mainly for family use (meat consumption) or as a part-time enterprise with the potential for local (cottage industry) market development. Globally, other species, such as ducks, geese, guinea fowl, and guinea pigs, also represent regional cottage industries. Rabbit production can certainly be industrialized, but it should be clearly understood that this development can only be justified in special cases where economic conditions are highly favorable. The 1978 Yearbook of Agriculture (TRAVIS *et al.*, 1978), recommended that small producers should establish their own local markets if living more than 150 miles from a processor. This would surely involve the majority of U.S. rabbit producers, and would explain the prevalence of small (less than 50 doe) operations (MCNITT *et al.*, 1996).

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**Rural rabbit project in Guatemala managed by women. Village women developed a viable market for rabbit skin products using local tanning and dyeing technologies.**

Therefore, with the exception of limited situations where commercial production is justified, as rabbit specialists our mission should be to assist small-scale or backyard rabbit micro-enterprise development. In other words, to the novice producer we would recommend: *Start small and stay small!* In many cases, this will involve only a 5 to 10 doe operation. There are a number of clear advantages to this approach. First, such a down-scaled unit generally represents a more favorable "economy of scale" of production (i.e., rabbit meat is less expensive to produce for family consumption), although productivity (e.g., annual litter production per doe and growth rate) may decline. Cost reducing measures would include: feeding homegrown forages, and garden and kitchen "wastes"; using an existing or simple shed, rustic cages, and common feeders and waterers; and sharing labor among family members (as opposed to hired labor). There are marketing advantages, as well, such as eliminating the "middle-man" and lowering transportation costs with regard to local, niche marketing of rabbit fryers. The potential benefits of cottage industry development are especially applicable to lesser developed countries, but perhaps less so to developed countries (e.g., Canada and the U.S.) with a higher standard of living and more sophisticated food marketing and distribution systems. In the latter countries, large

commercial operations also realize a favorable economy of scale (e.g., bulk discounts on feed and supplies), whereby smaller producers find it difficult to compete. This situation explains why an operation that is neither large nor small is referred to as "no man's land" from an economic standpoint.

#### **Benefits of integration.**

A small-scale rabbit enterprise supports integrative practices (e.g., gardening, nursery production, and vermiculture), as well as potential local markets for rabbit by-products (e.g., tanned skins, foot charms, rabbit manure as "organic fertilizer" for gardens and flower beds, worms for fishing bait), which supplements small farm revenue, especially for low income families who sell their produce in the marketplace. HARRIS (1982) reported on the integration of rabbits, catfish, worms, and vegetables in greenhouses in New Mexico. The rabbit's diet was supplemented with greens from vegetables, and rabbit manure was either used for growing worms which were fed to catfish or used as compost for growing vegetables. Production costs were minimized. In Columbia, RODRIGUEZ *et al.* (1995), reported satisfactory growth performance in broiler chicks fed diets in which soybean meal was partially substituted by live red worms as a protein source. Many U.S. rabbit producers raise red worms in rabbit manure pits. Although live red worms could be fed to poultry or swine, it would need to be processed into dried worm meal if fed to other livestock. Also, several studies (ELEMELÉ *et al.*, 1980; FEKETE, 1984; LALL *et al.*, 1984) have involved the limited feeding of rabbit manure to other livestock, including rabbits. One should be aware of possible risks of human disease transmission when animal products or wastes of one species are fed to another species (e.g., Bovine Spongiform Encephalopathy). Rabbits have been raised over fish ponds to fertilize the water to increase algae production which increased fish harvests (LUKEFAHR and GOLDMAN, 1985). There are many other examples of simple rabbit integration which benefit the small farm family through increased food supplies and economic returns. General agriculturalists and extension agents have basic knowledge and experience in rural agricultural development. Such technical support would be valuable for small farm families with a backyard rabbit enterprise. In contrast, very few field workers have training or experience in commercial rabbit production.

#### **Opportunities for youth.**

As a family-oriented activity, a rabbit project is ideal for youth living in rural and peri-urban areas. In Texas, a 4-H rabbit project is one of the most popular activities among its youngest club members. The child learns basic



**Rural-based rabbit training of farmers in Central and South America involving the direct role of farmer leaders is an ongoing program effort of Heifer Project International.**

responsibility and animal management skills which can lead to other projects and be applied to other life situations. Similar youth clubs with rabbit projects have been reported in Belize (HPI, 1978) and in the West Indies (RASTOGI, 1987). The slogan from the National Rabbit Project in Ghana, West Africa, "Grow rabbit, grow children" (ANONYMOUS, 1979) aptly promotes the high nutritional value of rabbit meat. In Guatemala, a rural mission school established a successful regional rabbit project after teaching rabbit lessons to children and regularly serving them rabbit meat in their lunches. The children also were required to assist in the daily management of the stock. Graduates took breeding rabbits to their own home villages to introduce this activity to offset malnutrition in rural communities (LUKEFAHR, 1988). Another project in Peru involved an orphanage ("Tierra los Hombres") in which boys learned basic agricultural skills, including how to raise rabbits and grow gardens. Later, the boys were resettled in communities where these vital skills contributed to a better quality life (LUKEFAHR and CHEEKE, 1991). In Egypt, village rabbit projects which directly involved youth reportedly decreased the rate of youth migration from rural to urban areas (KAMEL and LUKEFAHR, 1989). Migration of youth to inner cities is a chronic social problem throughout Latin America. The rabbit's small size and low cost of production when raised as a backyard species supports such worthy youth engaged activities and opportunities for building stronger communities.

#### **Local market opportunities.**

Local meat sales from small rabbit farms have a

competitive advantage in lower costs of processing, inspection, and transportation. In many states in the U.S., there are no rabbit meat inspection laws, so processing plants are not essential and rabbit meat can be sold directly to the consumer. For example, at Texas A&M University-Kingsville, rabbit fryers from the college and from local producers are slaughtered (without inspection) and sold weekly to area stores and restaurants. The meat is sold at a considerably lower price to retail stores than rabbit meat which can be supplied by a major company from the midwest (\$5.04 versus \$8.79/kg cost to the consumer). In the Dominican Republic, staff at a rabbit training center slaughtered fryers weekly, then immediately

transported the meat in ice chests to markets in Santo Domingo (LUKEFAHR, 1988). In rural markets surrounding Mexico City, rabbit fryers are sold live to the consumer.

Rabbit farmer cooperatives provide economic opportunities for collective marketing among small-scale producers. In the outskirts of Lima, Mexico City, and Sao Paulo, the author has dined at restaurants which served popular local dishes of rabbit meat using fryers that had been collectively marketed from small-scale farmers. In Venezuela, SOTTOLANO and BENEZRA (1987) conducted a production survey in the vicinity of Marcaj which involved 74 production farms, some of which had less than 30 breeding does. Thus, market opportunities existed even for small producers. In Cuba, there is growing popularity of rabbit meat in inexpensive, "worker's restaurants" (PONCE DE LEON, 1996). In Trinidad, RASTOGI (1991) reported that small-scale rabbit production was competitive with chicken and pork production because the feeding of fresh forages to rabbits greatly decreased production costs. Also, in Argentina, TUKEM (1993) reported meat prices for rabbit, beef and chicken at \$3.50, \$2.90 and \$4.50/kg, respectively, which indicated favorable competition. Market research and surveys could provide useful information to determine consumer demand in urban areas which could be met by a network of small-scale rabbit producers.

#### **Project opportunities and training programs.**

Small-scale rabbit production offers opportunities for humanitarian projects that assist people who live in poor, rural communities. In general, rabbit farming start-up and operation costs are low relative to other livestock species. One major constraint, however, is that farmers

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may not have access to proper rabbit training and supervision. This single factor accounts for many past rabbit project failures (LUKEFAHR, 1988). Other factors documented by LUKEFAHR (1992) include: 1) rabbit project initiation without conducting a feasibility study; 2) limited local group participation; 3) limited markets; and 4) no effective plan for multiplication of rabbit raising from experienced farmers to new farmers. These constraints can be overcome through proper project planning and farmer training. There have also been many successful rabbit projects. In the past 12 years, Heifer Project International (HPI), a private voluntary organization based in the U.S., has conducted regional rabbit training in central (Guatemala) and south America (Peru) and in the Caribbean (Dominican Republic) to agricultural field workers and specialists and rabbit farmer leaders who work closely with limited-resource farmers (LUKEFAHR, 1988; LUKEFAHR and CHEEKE, 1991). The Food and Agricultural Organization of the United Nations (FAO) has also been active in implementing educational programs that promote small-scale rabbit farming (FAO, 1986). Self-teaching farmer manuals have been developed in many American countries. LUKEFAHR (1992) prepared a manual for persons who train limited-resource farmers how to raise rabbits. This consists of lessons plans, sample visual aids, references, etc., as well as a section on how to develop a local rabbit project from the feasibility study through the evaluation stage.



A commercial rabbitry in Latin America is a typical site for training, printed materials, tours, breeding stock, custom-dressed meat, etc... However, this enterprise type has been a high risk and marginally profitable business for many farmers and business entrepreneurs.

A number of notable projects, albeit mostly undocumented, have been successful throughout the Western Hemisphere. For example, in rural Panama, a typical rabbit operation consists of only two to six does that are supported on inexpensive feeds and provide meat regularly for the family (T. BENDIBURG, personal communication). In the Dominican Republic, a thriving HPI rabbit project managed by women on small farms has been documented (LUKEFAHR, 1988). In this project, women managed the stock, served rabbit meat to their families, and sold surplus fryers for cash. In Honduras, small-scale rabbit projects guided by HPI have been particularly successful with the indigenous Indian populations (T. WHEELER, personal communication). In Peru, the author observed a cottage industry which produced and sold Rex rabbit skins as a substitute for the diminishing supply of alpaca skins to meet the high demand by tourists. There is a need for rabbit specialists to provide their valuable expertise to offer opportunities for small-scale rabbit training (preferably conducted in target communities), and to share project experiences, both successful and unsuccessful, by publishing reports in the literature.

#### **New research priorities - future challenges.**

Should we retune our research priorities as rabbit scientists? Is it prudent to continue research programs that focus on technologies (e.g., pelleted diet formulations, artificial insemination, and automation systems) for commercial operations which typically represent a small industry that has limited growth potential and (or) economic instability? The author proposes that we generally shift our research priorities from large-to small-scale rabbit farming problems for reasons previously discussed. A proposed common research goal might be : *To develop a local rabbit production system that yields higher outputs at lower inputs involving no off-farm purchases that would supply inexpensive meat for the family, improve farm productivity, and supplement income through the sales of surplus stock.* Some examples of locally-based research priorities would include: suitable farm diets that could replace commercial pellets, local remedies for treating diseases (ethnoveterinary medicine), selection in local breeds for novel traits (e.g., forage intake



## CONCLUSIONS



**Business promotion of Rex rabbit production in Peru. Rex skin products are replacing dwindling alpaca skin products which are in high demand by tourists.**

capacity, low nutrient requirements, and thermo-tolerance), appropriate farmer training and extension methods, and niche market research and development. The first priority has already been addressed in numerous studies involving feeding systems based on local forages, such as sugarcane and leguminous trees in Columbia (SOLARTE, 1989; VALLEJO, 1993), sugarcane in Cuba (PEREZ, 1998), various legume forages in Ecuador (JOHNSTON *et al.*, 1989), sugarcane and velvet bean in Haiti (BIEN-AIME and DENAUD, 1989), alfalfa and orchard grass in Mexico (ESPINOZA-FLORES *et al.*, 1997), and spineless prickly pear cactus and *Leucaena* in Mexico and south Texas (RUIZ-FERIA *et al.*, 1998). Other related papers have been published in the former Journal of Applied Rabbit Research and in WRSA congress proceedings. International funding agencies, such as FAO, HPI, and the International Foundation for Science, place high priority on local-based research and(or) development projects. In Mexico, a national funding program (CONACYT) also sponsors such projects, including graduate student training. In addition, the electronic journal, *Livestock Research for Rural Development* ([www.cipav.org.co/lrrd/lrrdhome.html](http://www.cipav.org.co/lrrd/lrrdhome.html)), encourages the submission of practical, locally-based research papers (especially from developing countries) for publication.

Rabbit scientists hold the keys of knowledge and responsibility to direct their nation's government with respect to the most appropriate scale of production for rabbit farming. What image should we set: rabbit production as a commercial or as a cottage industry? Rabbit scientists who advise policy makers and livestock industry leaders in countries where there is not a strong tradition of rabbit meat consumption should exercise caution. In the Western Hemisphere, a poor track record of success for commercial rabbit production has, in many cases, mitigated otherwise positive attitudes and interests in small-scale rabbit projects that could benefit the poor. This is in spite of the high potential of rabbit projects as an intervention for human development. If a nation's goal is to increase the standard of living for its citizens, would this best be served by commercial rabbit farms and plants which are owned by wealthy business entrepreneurs who provide limited, low-wage employment opportunities? In developing countries, commercial-scale poultry and swine production has failed to benefit the poor (probably also true for commercial rabbit production); rather, only the business owner and urban consumer benefits (UDO, 1997). The alternative, "back to basics" approach would be to develop small-scale rabbit projects aimed at poor farm communities whereby food security and increased income could be directly realized. Opportunities to achieve major impact indeed exist to foster human development and improve the image of rabbit production.

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## REFERENCES

- ACKER D., CUNNINGHAM M., 1998 : *Animal Science and Industry* (5th Ed.). Prentice-Hall, Inc. Upper Saddle River, NJ.
- ANONYMOUS, 1979 : Ghana's rabbit project. *Africa Report*. Jan.-Feb.:47-48.
- BIEN-AIME A., DENAUD L., 1989 : Feuilles de velvet bean et jus de canne-a-sucre pour la complementation du lapin en Haiti. *Livest. Res. for Rural Dev.*, 1(1), 1-5 (HTML version, pp. 5).
- CHEEKE P.R., 1985 : Rabbit production and research in Brazil. *J. Appl. Rabbit Res.*, 8, 122-125.
- CHEEKE P.R., 1988 : Rabbit production in the North America. In : *Proc. 4th World Rabbit Congr., Budapest, Hungary*, 1, 57-61.
- COLIN M., 1994 : La cuniculture Nord Americaine : II - Le Mexique. *World RabbitSci.*, 2, 7-14.
- COLIN M., 1995 : La cuniculture Sud-Americaine : II - Le Brésil. *World RabbitSci.*, 3, 85-90.
- COLIN M., LEBAS F., 1995 : Le Lapin dans le Monde. *Association Française de Cunicultureédit, Lempdes France.*

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- COLIN M., LEBAS F., 1996 : Rabbit meat production in the world. A proposal for every country. In : *Proc. 6th World Rabbit Congr., Toulouse, France, 3*, 323-330.
- DAVILA T.E.C., 1984 : Mercado de la carne de conejo en la ciudad capital de Guatemala. *Tesis. Universidad de San Carlos de Guatemala. Guatemala City*.
- ELEMELE H.O., RAO D.R., CHAWAN C.B., 1980 : Evaluation of rabbit excreta as an ingredient in broiler diets. *Brit. Poultry Sci.*, **21**, 345-349.
- ESPINOZA-FLORES F., ESPINOZA-VELAZQUEZ J., PRO-MARTINEZ A., BECERRIL-PEREZ C.M., TORRES-HERNANDEZ G., 1997 : Postweaning performance of two New Zealand White lines and their reciprocal crosses fed a high forage diet. *World Rabbit Sci.*, **5**, 149-154.
- FAO, 1986 : Self-Teaching Manual on Backyard Rabbit Rearing. *Regional Office for Latin America and the Caribbean. Food and Agriculture Organization of the United Nations (FAO). Santiago, Chile. 231 pp*
- FEKETE S. 1984 : The nutritional value of rabbit excrement fed to rabbits. *J. Appl. Rabbit Res.*, **7**, 138-140.
- HARRIS D.J., 1982 : An integrated system for raising rabbits, catfish, worms and vegetables in a greenhouse. *J. Appl. Rabbit Res.*, **5**, 102-103.
- HPI, 1978 : Raising rabbits in Belize. *Heifer Project International Publishers. Little Rock, AR*.
- JOHNSTON N.P., JOHNSTON I., UZCATEGUI M. E., 1989 : The palatability of soybeans (*Glycine max.*), bitter lupine (*Lupinus mutabilis*), green peas (*Pisum sativum*), fava beans (*Vicia faba*), canario beans (*Phaseolus vulgaris*), and bayo beans (*Phaseolus vulgaris*) for rabbits, guinea pigs, and humans. *J. Appl. Rabbit Res.*, **12**, 96-100.
- KAMEL, L., LUKEFAHR S.D., 1989 : A note on social impact of village-scale rabbit project development in rural Egypt. *J. Appl. Rabbit Res.*, **12**, 259-262.
- KAPPEL M.N. 1985. Rabbit production in Chile. *J. Appl. Rabbit Res.*, **8**, 143-144.
- KENTOR W.E. 1990 : Rabbit raising in Haiti. *J. Appl. Rabbit Res.*, **13**, 69-70.
- LALL D., KISHAN J., NEGAL S., 1984 : Feeding value of dried rabbit excreta in the ration of sheep. *Indian J. Anim. Sci.*, **54**, 1005-1007.
- LEBAS F., COUDERT P., DE ROCHAMBEAU H., THEBAULT R.G., 1997 : The Rabbit: Husbandry, Health and Production (2nd Ed.). *Food and Agriculture Organization of the United Nations (FAO). Rome*.
- LUKEFAHR S.D., 1988 : Programming viable rabbit projects for Latin America and the Caribbean. *J. Appl. Rabbit Res.*, **11**, 33-37.
- LUKEFAHR S.D., 1992 : A Trainer's Manual for Meat Rabbit Project Development. *Heifer Project International Publishers. Little Rock, AR*
- LUKEFAHR S.D., CHEEKE P.R., 1991 : Rabbit project development strategies in subsistence farming systems. *Wld. Anim. Rev.*, **68**, 60-70.
- LUKEFAHR S.D., GOLDMAN M., 1985 : A technical assessment of production and economics of small-scale rabbit farming in Cameroon. *J. Appl. Rabbit Res.*, **8**, 126-135.
- MCNITT J.I., PATTON N.M., LUKEFAHR S.D., CHEEKE P.R., 1996 : Rabbit Production (7th Ed.) *Interstate Publishers, Inc. Danville, IL*.
- NIEDZWIADK S., 1988 : Rabbit breeding and production in Poland. In : *Proc. 4th World Rabbit Congr., Budapest, Hungary, 1*, 50-56.
- Owen J.E., 1981 : Rabbit meat for the developing countries. *Wld. Anim. Rev.*, **39**, 2-11.
- PARKIN R.J., 1973 : Commercial rabbit production. A report of a study tour undertaken in Belgium and France. *Agricultural Development and Advisory Service, Ministry of Agriculture Fisheries and Food. London, UK*.
- PEREZ R., 1998 : La integración de la producción animal en un ingenio azucarero. *Memorias 47th Congreso ATAC (Asociación de Técnicos Azucareros de Cuba). La Habana, November 11-13, 1997, p. 68*.
- PONCE DE LEON R., 1996 : Production system and technical improvement of rabbit breeding in Cuba. In : *Proc. 6th World Rabbit Congr., Toulouse, France, 3*, 401-406.
- RASTOGI R.K., 1987 : Low input systems of rabbit production in relation to small farms in the Caribbean. *J. Appl. Rabbit Res.*, **10**, 79-81.
- RASTOGI R.K., 1991 : Rabbit performance in Trinidad. *Trop. Agric. (Trinidad)*, **68(4)**, 317-320.
- RODRIGUEZ L., SALAZAR P., ARANGO M.F., 1995 : Lombriz roja californiana y azolla-anapaena como sustituto de la proteína convencional en dietas para pollos de engorde. *Livest. Res. for Rural Dev.*, **7(3)**, 1-12 (HTML version, pp. 12).
- RUIZ-FERIA C., LUKEFAHR S.D., FELKER P., 1998 : Evaluation of *Leucaena leucocephala* and cactus (*Opuntia sp.*) as forages for growing rabbits. *Livest. Res. for Rural Dev.* **10(2)**:1-16, (HTML version, in press).
- SOLARTE A., 1989 : Development of feeding systems for rabbits and guinea pigs, based on sugar cane juice and tree foliages. *Livest. Res. for Rural Dev.* **1(1)**:1-7 (HTML version, pp. 7).
- SOTTOLANO M.V., BENEZRA S., 1987 : Rabbit breeding in the area of the "Jaime Henao Jaramillo" experiment station. (in Spanish). *Informe Anual, Instituto de Producción Animal, Universidad Central de Venezuela, 146-148 [Anim. Breed. Abstr., 1988, 56, 3099]*.
- TRAVIS H., AULERICH R., RYLAND L., GORHAM J., 1978 : Rabbits suited to a few acres, and capital outlay is small. In: *1978 Yearbook of Agriculture. USDA. Washington, DC*.
- TUKEM S.A., 1993 : Situation de la production cunicole en Argentine. Réponse à un questionnaire. *Ralston Purina International*.
- UDO H., 1997 : Myths in livestock development. *Equator*, **9**, 5-10.
- USDA, 1997 : Agricultural Statistics. *National Agricultural Statistics Service. United States, Government Printing Office. Washington, DC*.
- VALLEJO V.E.Q., 1993 : Evaluacion de leguminosas arbustivas en la alimentacion de conejos. *Livest. Res. for Rural Dev.*, **5(3)**, 52-59.
- VIANA L. de S., 1988 : Present and future prospects for rabbit production and research in Brazil. *J. Appl. Rabbit Res.*, **11**, 176-177.