SUSTAINABLE AND ALTERNATIVE SYSTEMS OF RABBIT PRODUCTION

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ABSTRACT

The ideal small-scale rabbit production model (SSRPM) represents an alternative and self-supporting system, based on renewable farm resources, that embodies the greatest potential for achieving a favourable, sustained impact (chiefly nutritional and economic) on limited-resource farm families who are mostly from the lesser-developed countries. The objective of this paper is to address major issues and factors that influence the degree of impact from the three-tiered SSRPM as a development project planning tool. Sustainability issues of meat rabbit production profoundly depend on ecological (*e.g.,* renewable natural or on-farm resources), economical (*e.g.,* investment and operating costs and market outlets), and sociological (*e.g.,* gender sensitivity and community participation) aspects as external factors of the SSRPM. Intermediate factors that support or guide the SSRPM involve the dimensions of project development: feasibility, design, implementation, monitoring, and evaluation. Internal factors that influence SSRPM components (*i.e.,* genetics, materials for housing and equipment, diet quality, health management, and other factors) are likewise critical. In summary, as rabbit scientists, we should share a common mission of promoting appropriate - environmentally-friendly, economically sound, and socially acceptable - SSRPM's, designed to meet the forecast of increasing pressures on natural resources and greater demands for food for the rising world population. In this mission, if success is realized, we can claim that meat rabbit production, in part, indeed sustained humanity.

Key words: alternative agriculture, sustainable development, natural resources, rabbits.

INTRODUCTION

The scientific literature provides numerous definitions for the term, **sustainability**. According to GIBON *et al.* (1999), a consensus of definitions from the animal science literature emphasizes … "the need to care for the ecological, economical and sociological consequences of development choices for present and future generations". The companion term, **alternative agriculture**, is associated with sustainability. SARE (2004), Sustainable Agriculture Research and Education, a USDA-funded program, broadly defines alternative agriculture for commercial crop production (but certainly relevant to small-scale rabbit production) as "alternative cropping systems including sustainable, organic, low-input, biodynamic, and regenerative agriculture", the outcome of which: 1) Achieves the integration of natural biological cycles and controls, 2) Protects and renews soil fertility and the natural resource base, 3) Optimizes the management and use of on-farm resources, 4) Reduces the use of non-renewable resources and purchased production inputs, 5) Provides an adequate and dependable farm income, 6) Promotes opportunities in family farming and farm communities, and 7) Minimizes adverse impacts on health, safety, wildlife, water quality and the environment.

In addressing this wide array of issues and desired impacts, a plausible goal definition of sustainability as applied to rabbit farming is: *the continuous supply of rabbit meat, supported by renewable and natural on-farm resources, and produced from an integrated and diversified enterprise that benefits the farm family and the community with respect to the provision of nutritious meat and supplemental income*. Sustainability should not be confused with organic farming, which according to SUNDRUM (2001) reflects environmentally-friendly farming practices that avoid the use of pesticides and mineral nitrogen, while decreasing the number of farm animals per area unit and the need for non-farm inputs (*e.g.,* commercial feeds and "nonchemical" medications). Although a typical small-scale or backyard rabbit production system in a rural setting might qualify as an organic farm, the enterprise may or may not be sustainable. For example, poor farmer training or improper feeding practices could well lead to abandonment or failure of the rabbit enterprise.

Rabbit scientists have advocated for years that a tremendous potential exists for rabbits in the lesser-developed countries (LDC's), based on the virtues of the rabbit, documented decades ago in the classic paper by OWEN (1976). This potential has been realized in certain LDC's, such as Cameroon, China, Egypt, Ghana, and Mexico. Suffice it to say, rabbit projects that are designed, in part, to meet the above "sustainable and alternative" classification, would more than likely succeed compared to projects that ignore these critical aspects. Too, some scientists would argue that rabbit production, itself, represents an alternative to traditional agriculture production systems involving the major commodity species of livestock. Further, there are alternatives to intensive or commercial-scale rabbit production, such as low-cost rearing of meat rabbits in small numbers supported largely by on-farm resources (described herein as the small-scale rabbit production model [SSRPM]), to foster food security for limited-resource farmers.

According to the forecast from the WORLD FOOD SUMMIT (1996), an FAO-sponsored event held in Rome, food and feed production will need to be tripled in the LDC's to keep pace with the projected doubling of the human population by 2050. The time is ripe for rabbit scientists to "practice what we preach" to demonstrate the rabbit's unique role in meeting the needs of the world population, especially for the vast majority of limited-resource farmers that occupy the planet. Perhaps we could even borrow and modify from U.S. president, Herbert Hoover, the slogan: "Two rabbits in every pot"!

The purpose for this paper is to describe and promote the adoption of sustainable measures and alternative methods of the SSRPM from a holistic resource management perspective and with special emphasis for the LDC's.

SUSTAINABLE RABBIT FARMING: THE SSRPM AND INTERNAL FACTORS

A rabbit enterprise or development project must be sustainable in all aspects or factors that comprise, guide or affect the production system. An appropriate small-scale rabbit production model (SSRPM) is proposed herein using a simple wheel analogy (Figure 1, right). To describe the spheres of the SSRPM, *internal factors comprise the production components, such as the suitability of breeding stock, availability of local resources or materials for housing and equipment, diet quality, health management, and other factors*. Intermediate factors guide the development project, which include feasibility, design, implementation, monitoring, and evaluation. External factors - ecological, economical, and sociological – are environmental measures of technical soundness that affect the project. Obviously, one weak link in the sustainability wheel can cause the model to either collapse or be driven off track towards the course of project failure. Bearing these collective factors in mind, a useful approach is to question whether any one of these three-tiered aspects or factors creates the situation of farmer dependency. Limited-resource farmers should not have to rely, for example, on commercial feeds, imported welded wire, long-term technical supervisory assistance, husband approval, formal markets, *etc.* Careful planning of new projects or timely modifications of existing ones is absolutely vital to ensure lack of such dependency situations, which will aid to promote sustainability (Table 1). In addition, alternative or locally modified SSRPM's potentially exist, relating first to internal factors that are presented below.

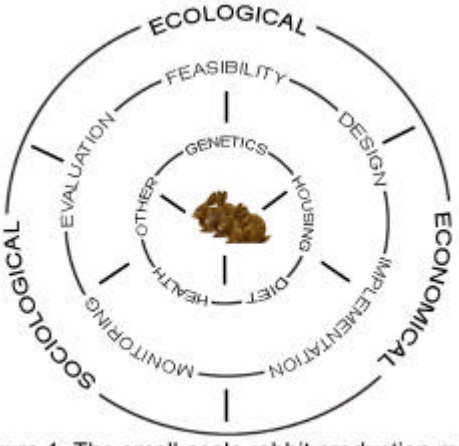


Figure 1. The small-scale rabbit production model (SSRPM) wheel of sustainability.

Genetics

If local breeds of rabbit exist that are adaptable to a unique environment, possessing possibly unique genes for novel traits, and if the population size is adequate (*i.e.,* not critical or endangered status), it is generally recommended that limited-resource farmers

utilize such local stocks. Although exotic breeds have been introduced throughout the LDC's, more research is warranted to ascertain their suitability relative to local breeds, assuming of course that local breeds exist. In some past projects, exotic breeds adapted poorly, resulting in project failure. Of course there have been exceptions. In Egypt (YAMANI, 1994) and in Uruguay (M. BASELGA, personal communication), for example, imported lines of commercial-bred New Zealand Whites have been reported to perform relatively well. In other project cases, farmers have been impressed by the production of F_1 animals (exotic x local cross); however, in the context of sustainability, how does the farmer breed the F_1 animal when replacements are needed (*i.e.*, the F_1 quandry)? Another pertinent breeding issue is appropriate selection practices and(or) genetic improvement programmes. In adverse environments, local breeds may display novel or functional traits, such as long ears, non-dense or sparse fur, and ability to subsist exclusively on forages without a source of drinking water. In this situation, it is imperative that research be conducted to justify selection practices aimed at increasing production traits (*e.g.,* litter size and growth rate). Likewise, research comparing local to exotic breeds should preclude the distribution of exotic breeds to farmers.

Is a dependency situation possibly created between the government breeding station or company and the farmer, for example? If the breeding station or company later closes, will farmers be less encouraged to stay in business? Also, does the utilization of exotic breeds or crosses put the status of the local breed population at risk (*i.e.,* "genetic erosion")? At the country level, such breeding issues need to be clearly addressed to promote sustainability of genetic resources.

Housing and equipment

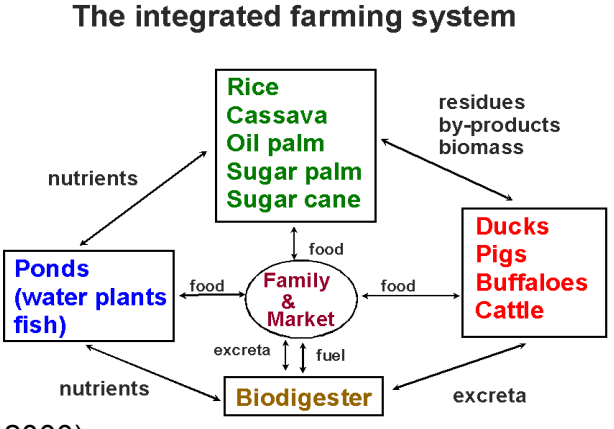
Ideally, housing and equipment should be constructed using local and renewable materials as shown in Figure 2 (right; LUKEFAHR, 1992). Mentioned later in the Ecological sustainability subsection, local materials should be renewable without exploiting the environment. However, in some development projects, limited and less expensive poultry wire netting is used for portions of the front-side of hutches, simply for "viewing ease". A common complaint by farmers about the use of wood materials is that rabbits will eventually chew through the wood and escape or weaken the hutch structure, making rabbits more vulnerable to predation. This concern is a legitimate one. The same argument is levied against the use of non-plant, natural materials, such as concrete, mud and stone, where rabbits can dig or burrow their way out from the hutch or pen enclosure. In some cases, welded wire is preferred, especially for farmers who are well established, but it should only be used without placing the farmer at high economic risk. In El Salvador, farmers initially used welded wire to have good housing, which encouraged their long-term project commitment (J. MCNITT, personal communication). However, a development organization, especially, should seriously address what farmers will do to replace their

wire hutches after they eventually wear out. It is generally more cost effective for farmers to better maintain, repair, and replace renewable hutches or pen enclosures than to make farmers dependent on the purchase of expensive welded wire.

A number of alternative housing systems have been reported in the literature. The pit system, consisting of underground cells, has been described by (FINZI and AMICI, 1991; FINZI, 2000), which has been recommended for rabbit rearing in hot climates, such as in the Saharan region. In tropical Vietnam, a study by NGUYEN QUANG SUC *et al.* (1996) reported favourable doe reproduction and fryer growth performance involving an underground shelter system of housing, which was studied on 30 farms in villages. A free-range system has also been described by FINZI and AMICI (1991) in which rabbits are maintained at ground level in large enclosures where they are allowed to burrow underground. In both systems, feed is brought to the rabbits, typically consisting of fresh-cut forages tied and hung in bundles. A similar free-range system was reported from Uganda by LUKEFAHR (1998) where farmers allowed their rabbits to graze for forage on their farms during the day, and later were collected and placed in small huts during the evening (with forage provided) as a safeguard against predators and thieves. In the village, dogs were actually trained to protect the rabbits. Yet, another alternative housing system is called "pastured rabbits". MCNITT *et al.* (2003) described this system in which rabbit fryers were kindled-in and(or) fed-out in movable grazing pens rotated over grass pastures, as opposed to fryers that were kindled and(or) reared in conventional cages. Reasonable production was noted, and this system is an option for producers striving to produce a more naturally-grown, grass-finished product to attract the more health-conscious consumers in which premium market prices are paid. In all cases, the alternative and sustainable housing or pen system should be simple and inexpensive for farmers to adopt, encouraging self-sufficiency rather than dependency.

Diet

According to the integrative and sustainable farming systems model of PRESTON (2000), the sun is the alternative to fossil fuel and nuclear energy, which should be harnessed as the ultimate energy source to grow crops that are the most efficient in the photosynthetic process, and yield amazing quantities of feed for livestock on small farms. Crops, such as cassava, sugar cane, and various oil palm species, produce forage, extractable sugars or juices, fruits or roots, which are not only suitable as feedstuffs for rabbits, but represent alternatives to fossil-fuel based cereal grain production (Figure 3; PRESTON, 2000).



Diet quality has been a major limiting factor of production in many rabbit programs. On farms it has been observed that a poor variety of feeds is provided (*e.g.,* only grass).

Reasons include, insufficient farmer training and (or) low motivation, lack of a feeding strategy plan, season, disaster, etc. Ideally, in the case of limited-resource farmers in the LDC's, feedstuffs for rabbits should be procured from the farm using inexpensive and renewable resources. However, exceptions may exist, for example, where use of a limited quantity of commercial concentrates may be justified. While forage plots are strongly recommended, some successful projects have been designed that promoted a simple rabbit-garden integrative model. In 1993, the author served as a consultant for Heifer International in Zimbabwe, where it was observed that a project supported by GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit) trained farmers to adopt the rabbit-garden model where garden "wastes" were used as primary feeds, forages as secondary feeds, and concentrates as supplements that were prepared using local grains (*e.g.,* rapoko, mhunga, and sorghum) and grain by-products that were grown on the farm. Legume forages are typically the most important source of protein for rabbits (CHEEKE, 1986). Dietary energy can be derived from many sources. The feeding of stale bread and tortillas has been reported (LOPEZ *et al.,* 1999; RAMCHURN and DULLULL, 2001). In addition, cull or surplus farm produce and kitchen scraps are oftentimes suitable as feeds for rabbits. The use of molasses blocks for rabbits is a feasible feeding alternative for many subsistence farmers (FINZI and AMICI, 1996; LE THU HA *et al*.,1996; LINGA *et al*., 2003).

Of relevance, the composition of the diet invariably changes over season as certain ingredients become more or less abundant (especially between wet and dry seasons). Proper training of farmers involving a forage security plan is essential. Of course, in light of the above discussion, the key to a sustainable feeding program is that the number of rabbits on the farm does not exceed the on-farm feed supply.

Health

Rabbits are a rustic species ideally suited for backyard or small-scale rearing. In many development projects, even under harsh or limiting conditions, rabbits are never vaccinated or given antibiotics, dewormers, coccidiostats or other prophylactic drugs or heath promotants. Yet rabbits are often observed to be healthy and productive. These attributes bode well with the essence of sustainability. Of course, there are exceptions. In countries or regions afflicted with RHD or VHD and Myxomatosis, rabbits are particularly vulnerable. While vaccination may be necessary, it may not always be feasible at farmer's level. Fortunately, in most LDC's, VHD has not been introduced. However, when a first-time outbreak occurs in a country, results can be devastating. For example, the outbreak of VHD in Cuba in 1993 was indeed dramatic. The importation of meat from China was implicated as the origin of VHD into the Western Hemisphere (LEBAS *et al*., 1997). In the realm of sustainability, governments should obviously protect rabbit agriculture from sources of potential bio-contamination, else sustainability is at stake. Outbreaks of Myxomatosis often follow the rain season when mosquitos swarms are prevalent, but the disease may also be spread by other biting insects, such as fleas and lice, so effective insect control measures at farm level are critical.

Under so-called primitive conditions, the more commonly observed diseases that can be controlled more easily than viral diseases are ear mites, skin mange, coccidiosis, and a variety of bacterial infections. Although most diseases are usually treatable if detected early (using local and effective remedies), the key is certainly prevention. It is imperative that proper and practical training of farmers, as well as of project support staff (*e.g*., Extension agents) be conducted. In my experiences, the root of most rabbit problems on small farms is faulty feeding and (or) poor sanitation practices, which can be addressed initially during farmer training. Secondly, and of equal importance, is timely on-farm visits (project supervision) by a rabbit project expert, which is essential to ensure that sustainability is not sacrificed by rampant disease outbreaks that should have been effectively prevented or controlled. Other internal factors may exist (*e.g.,* climate, predation/thievery risk, and waste disposal), depending on the local situation. Table 1 provides a general guide to determine sustainability involving internal factors.

Table 1. Sustainable and non-sustainable measures addressing the internal factors of the small-scale rabbit production model (SSRPM)[a].

Factor	Sustainable	Non-sustainable
Genetics	Appropriate stock Sound selection practices	Non-adapted exotics Unsound selection practices
Housing	Renewable resources	Costly imported, welded wire
Diet	On-farm resources	Commercial feeds
Health	Prevention/Local remedies	Expensive medications
Management	On-farm integration	Non-integration

[a] This table is only a general guide; in local situations, exceptions may well exist (*e.g.,* an exotic breed may be suitable and welded wire use may be justified).

SUSTAINABLE RABBIT FARMING: INTERMEDIATE FACTORS

Program dynamics

In terms of the anticipated project benefits of improved nutrition, occupational livelihood, empowerment of women, environmentally sound and more productive farms, *etc*., how does the farmer participate to effectively adopt the SSRPM? In many cases, the farmer either directly participates in a formal development program or indirectly participates as a generation recipient from a previously trained and (or) experienced farmer. *A development program plan or proposal should consist of several key components: project feasibility, design, implementation, monitoring, and evaluation. Each component*

is critical and serves as intermediate factors that will support or guide farmers who are adopting the SSRPM (Figure 1). A feasibility study first determines whether or not a rabbit project should be started. If a major constraint or barrier exists (*e.g.,* socially not accepted), a rabbit project should probably not be started. Instead, if the feasibility report recommends project initiation, then the project needs to be carefully designed, considering all the critical internal and external factors of the SSRPM. Project implementation and monitoring represent the actual life of the project (*e.g,* farmer training, stock distribution, supervision, and farmer-to-farmer multiplication). Project evaluation entails a document of the project's failures and successes from a learning or lesson point of view, so that future projects can be better designed. Proposals submitted to a development funding agency should generally address these five essential project components (for more detail, the reader is referred to the rabbit project manual written by LUKEFAHR (1992)).

SUSTAINABLE RABBIT FARMING: EXTERNAL FACTORS

Ecological sustainability

The SSRPM is a planning tool that: 1) serves to aid the farmer to be a good steward of the environment, 2) provides a strong economic incentive to produce, and 3) contributes to the goodwill of the family and community. *Ecological, economical, and social aspects are external or "environmental" factors of the SSRPM* (Figure 1). In terms of ecological aspects, the SSRPM consists of use of local building materials for constructing hutches and equipment that are obtained from renewable resources (Figure 4, right; LUKEFAHR, 1992), rather than using materials that would contribute to deforestation, global warming or soil erosion. As an integrated or symbiotic farming system, the rabbit's diet is based on feedstuffs that likewise are cultivated and harvested from plots or gardens. Further, integration practices involve nutrient recycling that protects the environment, such as planting legume forage species (*e.g.*, *Leucaena* and *Tricanthera*) to fix nitrogen into the soil, and using rabbit manure for composting to enrich soil fertility, increase water-holding capacity, and support beneficial soil micro-organisms. LUKEFAHR and PRESTON (1999) presented additional models of integration for sustainable rabbit farming, including rearing of rabbits in hutches over Tilapia fish ponds and rearing of guinea pigs or Muscovy ducks below rabbit hutches. To offset dependence on chemical fertilizers, rabbit manure has been used as a medium for horticultural, greenhouse or nursery plants, or for vermiculture (earthworm production). Worms are either sold for cash (fish bait) or fed to poultry or swine as a low-cost protein supplement (RODRIGUEZ *et al*., 1995). FINZI and AMICI (1989) reported on feeding rabbit slaughter wastes to

Muscovy ducks to minimize dependence and costs of commercial feeds produced from intensive and environmentally non-sustainable farming systems.

A salient feature of the SSRPM is that sustainable measures can be readily adopted by the limited-resource farmer, which also lend themselves well to diversification (combination of other crop and livestock activities) to further ensure food and economic security. In contrast, in commercial operations it is oftentimes simply not feasible to maintain sustainable or diversified systems due to labor and(or) economic constraints.

Economical sustainability

Ideally, and especially from a humanitarian aid standpoint, the rabbit project or enterprise should be designed such that farmers engage at minimal investment and operation costs, including labour. Minimal investment and operation costs are both realized if renewable resources (*e.g.,* local building materials, feedstuffs, and breeding stock) are available and properly utilized. If this favourable economic environment exists, such that limited-resource farmers are not exposed to major economic risk, then sustainability is certainly made possible. Moreover, benefits from meat consumption and sales of surplus stock should readily offset all expenses, and make significant contributions to diet quality and income earnings. LUKEFAHR and CHEEKE (1991) developed a 5-year cost and returns budget that included an economic analysis (*e.g*., opportunity cost, return to labour, and comparative advantage), which strongly justified small-scale rabbit enterprises.

For any alternative agricultural enterprise, including rabbit production, an economic incentive to produce must be justified. Simply, farmers will certainly abandon their rabbit enterprise unless strong markets exist. Markets have to be secured or established if a regional rabbit program is to succeed. Potential markets that can be created include, for example, traditional open markets, farmer's cooperative markets, food stores, cafes, street vendors, hotels, schools, and hospitals. A desirable economic situation in some countries where the market price of a rabbit fryer is less than that of a broiler chicken (to make rabbit meat highly competitive), but where the profit margin is higher for rabbit. Where stable markets do exist, it is imperative that farmers are not tempted to sell more rabbits than what they should be consuming so as not to sacrifice the desired nutritional impact of the program. Farmers can be trained the vital lesson to "eat two and sell one" to always emphasize the primary nutritional goal for rabbit programs in the LDC's.

Social sustainability

Of course, a sustainable and alternative (small-scale) rabbit program will more than likely be accepted by the rural community if the community, itself, is involved in the initial planning stages, and continually participates in decision-making aspects (*e.g.,* who amongst themselves will receive rabbit training and breeding stock). This "participatory approach" to development is highly recommended by world hunger organizations because it engenders a strong sense of project ownership among participants, among other direct benefits. A positive social environment of acceptance

has other dimensions, as well. To illustrate, are women allowed to engage in agricultural projects or be supervised on their farms by male extension workers? Do husbands allow their wives to handle money earned from rabbit sales? Are children encouraged, even rewarded, to participate in the rabbit enterprise so as to thwart the chances of them abandoning farming as a possible career and instead migrate to urban centres? Ideally, the target community should address all such relevant social aspects in planning the project, especially if a proposal is to be prepared and submitted for formal support and(or) sponsorship by a funding agency.

In recent years, an emergence of rabbit development projects directed at women and children has occurred. One recent project is a women-managed, rabbit project in Mexico (GÓMEZ, 2002). Both social status and income levels increased as a direct benefit. In Bangladesh, a regional survey revealed that 65% of women and 26% of children were the sole managers of rabbit enterprises (PAUL *et al.,* 2000). In Cameroon, LUKEFAHR *et al.* (2000) reported on how Heifer International, a humanitarian hunger organization, uses rabbits as a top priority project to elevate the social status of impoverished women and to improve the diet quality for their families. “Gender awareness” projects bring women together and engage them in leadership and (or) organizational, management, and marketing activities. Rabbit projects have also been designed for children by introducing rabbit projects at schools. The rabbit’s diet is typically based on kitchen “wastes”, rabbit lessons are incorporated into the agricultural curriculum, rabbit meat is served in cafeterias, and children later introduce rabbits in their home villages. Rabbit projects have also been aimed at orphaned children or AIDS victims because of the simple advantages of rabbits, including low start-up costs. In the context of development, sustainability could even be defined by world hunger organizations as those projects that were subsequently managed by the community, independent of technical assistance or funding, that continually impacted the lives of a multitude of rural and peri-urban based, limited-resource families. As a planning guide, a general checklist form is commonly used to screen projects for funding, in part, on the basis of the external factors described herein (Table 2).

Table 2. Sustainability checklist for external factors for planning rabbit projects[a].

Factor		Yes	No
Ecological	Recycle farm nutrients (integration)?	_____	_____
	Gardens or forage plot establishment?	_____	_____
	Renewable resources for building materials?	_____	_____
Economical	Low investment and operating costs?	_____	_____
	Loan possible for breeding stock?	_____	_____
	Availability/Opportunity for markets?	_____	_____
Social	Time available to raise rabbits?	_____	_____
	Participation of women and children?	_____	_____
	Respond to technical advice?	_____	_____
	Regular consumption of meat acceptable?	_____	_____
	Promote the goodwill of community?	_____	_____

[a] This table is only a general guide; in local situations, other external aspects or issues may need to be addressed.

CONCLUSIONS

The primary focus of this paper was on the proposed small-scale rabbit production model (SSRPM) - a planning tool applied to foster sustainability to aid in human development, especially in the LDC's. However, in developing or developed countries, any responsible rabbit enterprise should embrace the goal of sustainability. For limited-resource, small farm families, the procurement of a few breeding rabbits, largely supported by renewable on-farm resources, can potentially yield enormous and permanent benefits. In this paper, only sparse reference was made to research. Nonetheless, a novel line of "sustainability research" is encouraged that evaluates or tests SSRPM factors under local situations. Ensuing dialogue is needed to develop guidelines for enhancing and promoting sustainability aspects of rabbit production that can be widely adopted. If successful, the mission of rabbit scientists to meet increasing demands and challenges of the world population might be fulfilled.

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