Partners in PRODUCTIVITY

Farmers and Scientists Collaborating in the Research and Development Process

Small Ruminant-Collaborative Research Support Program
Research Institute for Animal Production
Central Research Institute for Animal Science
Agency for Agricultural Research and Development
Ministry of Agriculture

Bogor, September, 1990

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Acknowledgements

Special thanks is given to the scientists and staff of the Ministry of Agriculture, the Agency for Agricultural Research and Development, the Central Research Institute for Animal Science, the Research Institute for Animal Production, USAID and the small ruminant farmers for their collaboration in this research project.

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United States Agency for International Development
Grant No. DAN 1328-G-SS-4093-00

Introduction

Developments such as the following story are but one of the results of the research activities in Indonesia conducted under the Research Institute for Animal Production (RIAP) as the executing agency of the Agency for Agricultural Research and Development (AARD). RIAP work in collaboration with the Small Ruminant-Collaborative Research Support Program (SR-CRSP), a joint effort of the Republic of Indonesia and the United States Agency for International Development (USAID).

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The children of Indonesia look forwad to a bright future as small ruminant farm families work vigorously to build a better future.

Outreach Project Farmer

Like many small farmers in West Java, Pak Mamad cultivated both paddy rice and food crops. Before participating in the Small Ruminant-Collaborative Research Support Program/Research Institute for Animal Production (SR-CRSP/RIAP) research project, he only had 2000 m2 of dry-land that he cultivated in annual plants such as petai, albizia and bamboo. He worked for five days as a farm laborer in the nearby coconut estate for a wage of Rp. 1000/day ($ 0.60). Almost half of this went for round-trip bus fare. To meet the family needs for rice and for seed, his wife Maryam worked as a farm laborer in their village.

At the beginning of the Outreach Pilot Project (OPP) of the RIAP/SR-CRSP program in August 1984, Mamad and two of his friends formed a group and received 5 ewes plus 1 ram and a subsidized loan from the research program to build a barn. Early in the project the three farmers decided to separate and care for the animals as individuals instead of as a group. He kept a ewe and a ram and his two friends each received 2 ewes. During the first two years, he raised his animals in the original barn. However, he soon needed another barn, and he built it from profits from animal sales.

Now Mamad works as a temporary farm laborer within the village, and Maryam sells traditional snacks every morning to school children. He spends much of his time caring for his sheep by cutting grass for fodder and carrying it 2-3 km to his village. He follows the on-farm research team's advice on small ruminant management by providing water, salt, and tree legumes daily. Mamad and Maryam share animal care duties. They clean the barn daily and monitor the health of the sheep. Weekly, they collect the manure from under the raised barn to use as a valuable fertilizer on their dryland crops.

Mamad and Maryam consider the OPP to have made a positive impact on helping smallholder farmers in their village increase family incomes. Mamad contends that small ruminants, incorporated into the small-scale farming systems in Indonesia, can help generate new opportunities for economic improvement either as a means for family savings or by generating profit from animal sales. Mamad already has sold 21 animals, and slaughtered 3 yearlings for Islamic holiday celebrations during the past 5 years. He is pleased with his achievements in sheep production because he can now share 4000 m2 of land with his neighbor for cultivating sweet corn and beans. Someday, he and his wife plan to purchase the land. Most recently, they sold 8 animals for Rp. 400,000 to renovate their house, covering the dirt floor with tile and replacing the tile roof.

Small ruminant farm family from West Java.

The Importance of Sheep and Goats in Indonesia's Overall Agricultural Production

The 13,000 islands of Indonesia are strung along 5,000 km of sparkling coral sea forming the world's largest archipelago. Indonesia is home to more than 182 million people, consisting of more than 300 ethnic groups, each with it's own unique culture and language. Bahasa Indonesia is the official language of the country and provides unity among its diverse people.

The population of small ruminants in Indonesia is the largest of any country in the ASEAN region, 10.4 million goats and 5.4 million sheep (1987).

Sheep and goats are widely distributed throughout Indonesia. However the island of Java, which accounts for only 7% of the nation's total land area is under intensive crop production and also supports more than 60% of the country's goat and sheep population.

In Java, small ruminants are raised by smallholder farmers and fed under intensive cut-and-carry systems, often combined with seasonal or limited grazing. This traditional cut-and-carry system prevails particularly in West Java, where almost 1/2 of the country's sheep population is found and where the average smallholder farmer keeps 3-4 small ruminants.

Less intensive grazing management systems remain restricted to areas where food crops are not the primary agricultural production activity. Grazing occurs on a seasonal basis and in areas where estate crops are predominant.

Sheep and goats are important to the welfare of smallholder farmers and landless agricultural laborers in Indonesia. Increasing small ruminant productivity, particularly among women farmers and smallholders, is recognized as indispensable for achieving the short-term goals of national food security and improved human nutrition. Moreover, increasing agricultural production, in which small ruminanrs play a role, provides the foundation for fulfilling the long-term development plans envisioned by national economic planners and agricultural policy makers.

In Indonesia's nearly 20 million small farming households, small ruminants have several advantages over large ruminants such as buffalo and cattle. Sheep and goats require modest initial investment and maintenance costs are relatively low. Other special advantages include, less forage to feed per animal unit, reduced raising space requirements, and lower risk. When rain is in short supply during part of the year, small ruminants often are the only livestock that can be kept in some areas. Furthermore, they are able to feed on marginal land and crop residues. In many instances, they serve a number of other functions in the farming system-e.g. as a means to accumulate and store capital, a way to increase social status, and a source of manure fertilizer. Sheep and goats also have an important role in social and religious ceremonies. During such activities, the demand increases

A farmer feeding cassava leaves to his goats.

A farmer proudly displays his goats.

approximately 3 times higher than normal for male animals.

Over the last decade, awareness of the potential contribution of sheep and goats in both traditional and transitional agricultural systems has increased significantly. Furthermore, the consumption level of animal protein in Indonesia is low, particularly in rural areas, because of various socioeconomic constraints. In this context, research and development on improving sheep and goat production can contribute substantially toward realizing production potential and improving family nutrition.

In the context of international trade, small ruminants have a bright future providing motivation for entrepreneurs and smallholder farmers to initiate and expand private business enterprises in small ruminant production. Specific potential markets include the Middle East and population centers in many ASEAN countries

Small Ruminant Production : Importance in Relation to Labor Force

As an activity involving family participation, small ruminants provide employment for many smallholder farmers and landless laborers. In fact, for farmers with minimal land holdings, sheep and goats offer an important source for employment. Family members with a relatively low-opportunity labor cost, such as young and elderly persons, can tend the animals raised under intensive (cut-and-carry) or semi-intensive (grazing) production systems.

Women farmers make an important contribution to small ruminant production.

The Indonesian Program

The Small Ruminant-Collaborative Research Support Program in Indonesia

In order to increase the production and economic utility of small ruminants for people in developing countries, USAID launched the overall Small Ruminant-Collaborative Research Support Program (SR-CRSP) in 1978 with a Title XII grant projected over a 13-year period ending in September 1990. Currently, this program operates with 10 U.S. institutions (9 universities and a private non-profit research institute) in collaboration with institutions in Indonesia, Kenya, and Morocco. Brazil and Peru participated actively in the earlier stages of the program.

This worldwide USAID program recognizes that small ruminants can enhance family income, increase employment and cash flow, and reduce risk, in addition to providing meat, milk, hides, fiber, and fertilizer to a large percentage of the world's population, especially low-resource, smallholder farmers.

Since the formal beginning in 1980, the collaborative research program in Indonesia has been productive and has developed excellent working relationships with other agencies such as the Research Institute for Animal Disease (RIAD) and, more recently, with the Central Rubber Research Institute (PPP) in North Sumatra.

This research has involved collaborative work among U.S. and Indonesian scientists, supporting the priorities they identified, and emphasizing CRSP's role as a research program. Participating institutions in the U.S. have concentrated on research and training. The shared goals of the Indonesian and U.S. scientists have been to develop self-sustaining, productive Indonesian research programs and animal production technologies.

Although agricultural extension is outside the SR-CRSP mandate and its host institution in Indonesia, the program has developed on-farm technology development research methods that can be used by the Indonesian extension service.

Scientists conducting on-station experiments related to heat stress.

Research is being conducted to increase the production of high quality forage.

Research and Development

Research Strategy

In order to reduce the existing gap between current village sheep and goat productivity and actual animal potential, research was oriented to identify the main constraints on production and to develop technologies to overcome these constraints. Solutions needed to be both economically feasible and socially acceptable. Under this framework, the SR-CRSP/RIAP research projects have ranged from highly focused disciplinary attempts to solve specific production problems to broad based, team oriented, indisciplinary field studies. Much of the work involved cooperative efforts among scientists of various disciplines.

The SR-CRSP/RIAP activities in Indonesia are reflected in the development of the research program over the last 10 years. These activities included : baseline data collection (description/diagnostic), technology development (on-station research trials), and on-farm testing.

In terms of national development, two critical areas where small ruminants play or may play an important role as components of the farming systems, can be identified in Indonesia. Consideration of the constraints on productivity and socioeconomic factors in these areas determined the definition of research priorities and the research strategies of the SR-CRSP/ RIAP collaborative program.

The two main areas are :

1. **High rural human population density areas : The case of Java.**

The island of Java provides an illustration of the dramatic changes in availability of forages and other feed resources dictated by a net reduction of agricultural land for forage production. Reasons for this irreversible process are : incorporation of more areas for crops, urban expansion, population growth in rural areas and industrialization. In these areas, changes in the natural vegetation and intensive cropping are also associated with erosion problems. Research priorities/strategies have emphasized intensive cut-and-carry small ruminant production systems and technological options to maximize or intensify production levels. An example is in watershed regions with high potential for semi-intensive production of small ruminants.

2. **Areas under low human population pressure also characterized by low numbers of small ruminants** : Integrated plantations and transmigration areas.

The potential availability of more fresh forage under tree cropping systems including rubber, oil palm, coconut etc., widely distributed in Sumatra and other islands offers a tremendous potential for small ruminant production expansion. Research strategies now emphasize integrated tree cropping with small ruminant production systems. New agricultural areas in the humid and semi-arid zones, such as those involving transmigration programs, offer additional potential for intensive or semi-intensive production systems. Although no formal strategies were developed for the new potential areas, such as those of the watershed and transmigration development program, present research results could be useful in defining or designing new production models.

Sheep grazing under extensive production systems.

Highlights

"Prolific line" rams awaiting fresh forages in the experiment station.

Highlights of Achievements in Indonesia

Numerous research projects require long-term (5-10 year) research agendas before yielding results. Some projects only now are beginning to provide answers. Data from earlier projects became the basis for ensuing research and for determining long-term potential benefits. Some projects of shorter duration already have provided information of direct practical use to producers. Examples of achievements of the SR-CRSP in Indonesia include :

1. ON-STATION AND SURVEY RESEARCH

- **Breed characterization on estimation of the production potential of Javanese Thin-Tail (JTT) and/ Sumatran Thin-Tail (STT) sheep.** With a potential to breed year around, both breeds are suitable for intensive production systems; the former for cut-and-carry based feeding and the latter for grazing forage under tree crops such as rubber.

- **Determination of the mode of inheritance of the prolificacy.** Utilization of these high and low prolificacy lines may define breeding stock with optimal prolificacy for a range of environments.

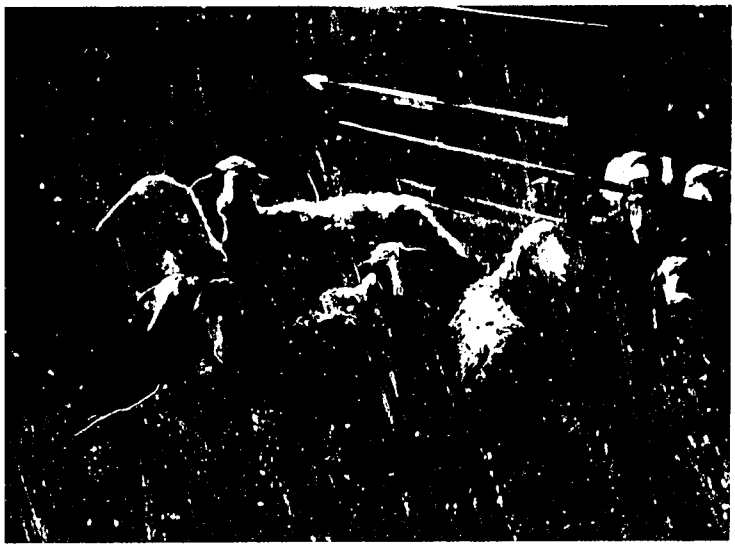
- **Feasibility of shortening the lambing intervals.** On-farm technology testing indicated that farmers can reduce lambing intervals from 14 months to less than 9 months by proper rotational distribution of available rams and estrus detection.

- **Development of a genetic improvement program in North Sumatra.** Improved unconfined Sumatran Thin-Tailed (STT) sheep for grazing forages in rubber plantations. This program implemented two simultaneous breeding plans: 1) establishment of a nucleus of STT for selection and, 2) establishment of a crossbreeding flock based on crosses between Saint Croix hair sheep and STT.

- **Demonstration that supplementation of tropical grasses improved growth and reproduction.** The supplementation consisted of complete mineral mixtures, low-fiber feeds and nutrition management practices that village farmers could provide at low cost.

- **Development of feeding technologies to increase production.** These included: a) supplementation with tree legumes such as gliricidia, leucaena, and sesbania (an outstanding contribution for areas where supply of fresh forage is subject to great fluctuations or is on a decline due to the reduction of pastoral areas, b) supplementation with several locally available agricultural by-products such as residues from soybean curd, rubber tree seed, oil palm kernel, kapok seed, molasses, etc., and, c) incorporation of salt and minerals as a common feeding practice.

- **Integrated minimum cost diets.** These diets contained a small portion of fresh forage for areas with a constrained fresh forage supply and unrestricted availability of agricultural by-products, which can support body weight gains equal to or greater than 100 g/day, a desirable performance growth standard for Javanese sheep.



Prolific ewes from Cicadas experiment station in West Java.

- **Development of an integrated sheep and rubber production system.** This project, based on grazing and strategic supplementation, intends to substantially reduce plantation weeding costs while allowing expansion of SR production. Rubber seeds, an overlooked source of protein and energy, have successfully been processed and used as a feed supplement for lactating ewes and lambs.

- **Definition of the roles of various family members in crop/livestock farming systems.** SR-CRSP/RIAP social scientists have identified and clarified the age and gender responsibilities toward small ruminant production within the households of Indonesian farming families.

- **Determination of the sociological and economic constraints on labor.** Research has provided information explaining the key role of woman in the production system. This information that should be given serious consideration to encourage increased productivity and women farmers should be included as recipients of extension services.

- **Large scale pricing efficiency and marketing studies of Java and North Sumatra.** Researchers have gathered data concerning livestock markets, slaughter houses, middlemen, and farmers' marketing strategies. This information is used in the technology packages developed for small holder farmers.

- **Determination of marketing constraints.** The role of the middleman; acceptable levels of risk; investment requirments of labor, capital and other resources; the relevance of religious celebrations on the marketing of SR on the basis of the animal's age have been studied and marketing schemes have been developed with the farmers assistance.

The RIAP/SR-CRSP has provided the farmers with the first production handbook written in the Indonesian, Sundanese and Javanese languages.

The manure produced by animals provides a valueable source of high quality fertilizer.

2. ON-FARM RESEARCH AND TECHNOLOGY PACKAGE DEVELOPMENT

- **Established pilot projects.** Working with selected farmers in West Java and North Sumatra to apply and validate, in a multidisciplinary fashion, the research results produced by on-station research activities. The projects are known as the **Outreach Pilot Project (OPP)** in West Java and the **Outreach Research Project (ORP)** located in North Sumatra. The OPP has demonstrated a reduction in the traditionally high levels of lamb mortality (30-60%) to levels below 12% and reduced lambing intervals resulting in a net increase in the lamb crop.

- **Technology information packages.** Developed through the Outreach Pilot Project, these packages have increased the farmers' ability to manage sheep and goats and demonstrated the viability of an integrated approach to agricultural research.

3. PROFESSIONAL TRAINING AND SUPPORT

- **Short and longterm training.** Both in Indonesia and overseas, involving scientists and technicians from the Small Ruminants program at RIAP.

4. COMMUNICATION, PROMOTION AND NETWORKING

- **Publication of 120 working papers.** In a delineated, by-discipline series, and publication of a large [illegible]cientific papers in recogniz[illegible] journals.

- **A comprehensive, [illegible]-page sheep and goat production handbook.** Written for farmers and extension personnel using pictures and limited text and produced in Indonesian, Sundanese, Javanese and English editions. Entitled; *Kumpulan Peragaan Dalam Rangka Penelitian Ternak Kambing dan Domba di Pedesaan* (Collection of Training Materials Within the Framework of Goat and Sheep Research in the Village).

Participatory Approach

The Outreach Pilot Project (OPP) and the Outreach Research Project (ORP)

At present, the research program is in the interdisciplinary on-farm testing phase. Key elements of this phase are the Outreach Pilot Project (OPP) in Bogor, West Java and Sei Putih, North Sumatra, where technology package development focuses on production problems identified by farmers. The technology information packages are produced by the scientists in the various disciplines (i.e. economics, nutrition, breeding, etc.) through discussions and collaboration with farmers. This method blends traditional knowledge with current research information.

The OPP was started in 1984 in the Bogor district of West Java with several objectives. Primarily, the OPP aimed at establishing a dialogue with 46 farmers organized into 19 groups and to develop appropriate small ruminant management technologies. It was anticipated that these new technologies would increase farmer incomes from sheep and goat production.

Women are often the cornerstone for many family and village incomes.

A typical raised sheep or goat barn used in West Java.

In 1988, a similar on-farm program was initiated in Sei Putih, North Sumatra, with 12 farmers under similar arrangements. The Outreach Research Project (ORP) in Sei Putih was aimed at evaluating cross-bred sheep in integrated tree cropping and sheep production systems.

These two "field laboratories" have been established in collaboration with the local livestock service. Each "laboratory" consisted of a selected group of farmers who were given a subsided loan and received five ewes/does and one ram/buck per group of farmers. The farmers were asked to return the second offspring to the government livestock service and the fourth offspring from each animal to the research institute. The remaining offspring were distributed among the members of the farmer group. Infertile animals were replaced.

Through the activities of the multidisciplinary research team, the OPP/ORP focused on developing farmer management awareness. This approach was designed to provide small ruminant farmers with an opportunity to participate as partners in the project rather than as passive recipients of information and advice. Furthermore, emphasis was on recommendations relevant to the needs and resources of small-scale farmers, for example, identifying constraints to marketing sheep and goats.

To strengthen the OPP's information collection, dissemination, and technology testing procedures, a more intensive information exchange program was developed and incorporated into the program in January 1988. This collaborative research format was facilitated by establishing mutual trust and recognition by the researches of the need for the farmers' assessment of the management technologies being developed. Earlier SR-CRSP research confirmed that animals performed better when the farmers had regular contact with scientists and extension agents. Effective communication with farmers, therefore, is a key to successful on-farm animal research and technology development.

In the OPP, emphasis has been on shortening the lambing interval, reducing lamb mortality, increasing weaning weights, improving marketing information for farmers, improving feeding management, and improving barn design. The data from the OPP farmers has shown that a combination of shorter lambing intervals, lower lamb mortality rates, and higher proportion of ewes successfully being bred consistently raised reproductive performance. A major part of this improvement is believed to result from the typical application of breeding, feeding and management recommendations developed in the SR-CRSP. The information on the various disciplines is then collected into a technology information packet for discussion with and demonstration to farmers.

An important achievement in the OPP was a substantial reduction of the lambing interval from the typical village average of 12-15 months to levels equal to or less than 8 months, as shown in Table 1.

The on-farm research team discusses production problems and collects monthly data.

This shift has a marked impact on flock productivity in that it implies a potential lambing rate of 3 lambings in 2 years; a net annual increase of 50%. With an estimated population of 2 million adult ewes in West Java and assuming only one lamb per lambing with 85% lamb survival, the change in lambing interval potentially could represent a production of 5.1 million lambs per year compared to the present production of 3.4 million lambs under the one lamb/lambing assumption. No less important, was the adoption of management practices that significantly lowered average lamb mortality from greater than 20% to less than 12% (Table 1) This represented more lambs weaned per ewe and continued expansion of farmers' income.

Outreach project farmers proudly display their animals.

Farmers and researchers discussions are an important information exchange method.

Although research in the OPP did not focus on increasing flock size, farmers comprising the group of best producers increased the size of their flocks from an average of 3.9 to 6.5 head.

Analysis of this trend indicates that more breeding ewes in the flock may imply a substantive change in the nature of the production system with a potential for further development due to attractive marketing prospects for small ruminant production.

New facets of research include strengthening the already intensive production system upon the conclusion of the OPP. This research will focus on market oriented production schemes at the village level.

Table 1. Production performance levels in OPP villages in West Java

Production trait	Average Production Villages	OPP
Lambing interval	365-450 days	**246 days**
Lambing rate in 2 years	2 lambings	3 lambings
Lamb mortality	**27%**	< 12%

> greater than
< less than

Among the most encouraging aspects of the OPP and ORP is the quality of the feedback from farmer participants. One way to measure feedback is continuing farmer attendance at scheduled participant meetings held by the OPP staff. In earlier stages of the SR-CRSP, records of farmer's questions provided valuable feedback. A more formal measurement was obtained by questionnaires. All three types of feedback have been useful. However, these techniques still tend to frame farmers as fairly passive participants in the research process, i.e., more as technology evaluators than as technology generators. Therefore, OPP and ORP research teams continually solicit information and suggestions from farmers to address this concern.

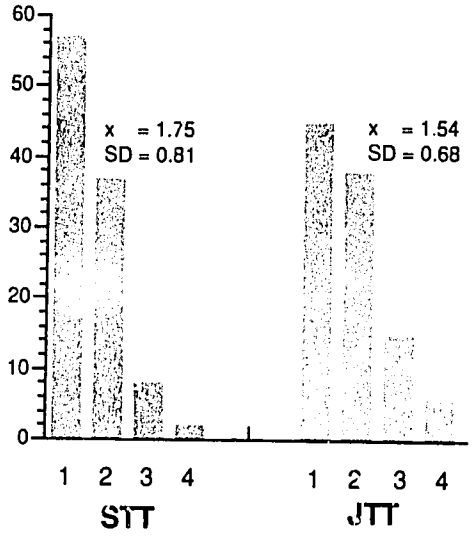
In this type of interdisciplinary research, there clearly are significant methodological difficulties inherent in evaluating the impact of these models of technology development and transfer. While monitoring such a project is relatively straightforward, evaluation of the recommended technology packages requires an in-depth analysis of animal production and performance variables and their impact on family income and improvements in family welfare. It is difficult to separate or attribute improvements in family welfare as a function of technological changes in just one component of a farming system, in this case, small ruminants. This research project continues to emphasize the need for innovative technologies that are technically and economically feasible as well as socially acceptable to small ruminant farmers.

On-Station Research and Development on Prolific Sheep

A visitor to a typical West Java smallholder farm can observe an interesting situation: a high proportion of the ews in each flock will be raising twins, triplets, or quadruplets, rather than the usual single lamb. This condition, known as prolificacy, occurs in only a few of the many sheep breeds in the world, the Javanese sheep being one of them.

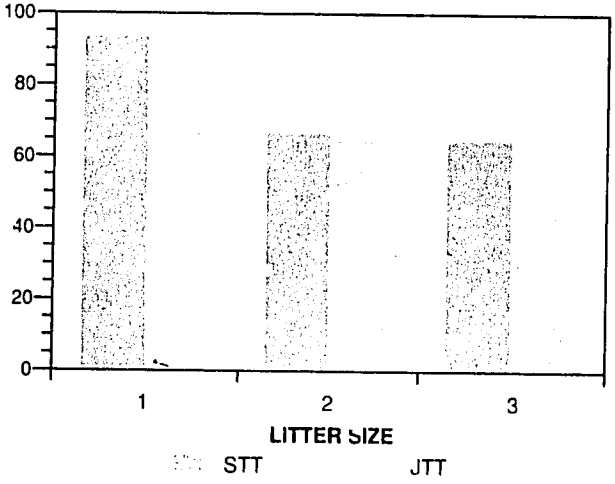
Figure 1 shows the distribution of litter size found in the Javanese Thin Tail (JTT) sheep at the Cicadas research station, West Java and also provides information on the Sumatran Thin Tail (STT), another prolific breed in Indonesia.

Fig 1. Distribution of litter size in STT and JTT sheep

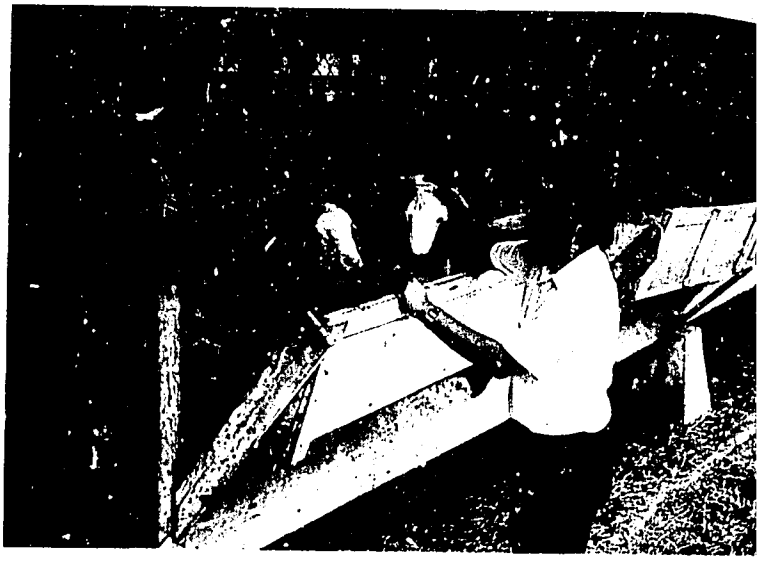


Prolificacy is a desirable condition and goal of breeding programs in situations oriented toward maximizing the overall productivity for meat production. This is particularly true in environments that can support the increased nutritional demands imposed by the larger litter sizes of each ewe. This results in a preference for prolific sheep among sheep breeders. For instance, a survey among sheep farmers in West Java revealed that farmers preferred prolific ewes to those producing only single lambs. They also had a marked preference for a prolificacy ceiling of two lambs per ewe per lambing. The reason for the latter is high mortality in lambs from litters with more than two lambs (Figure 2).

Fig 2. Lamb Survival in STT and JTT sheep



Prolificacy represents a special case among quantitative production traits. It has an intermediate level optimum which varies with the production environment, nutrition and level of management. Under harsh environments, constrained food supply and a low-level of management, a single lamb is usually the optimum. Under more favorable conditions, typically found in areas of higher rainfall,



On-station sheep prolificacy testing is an important part of the research program.

or situations which can be created by strategic supplementation as in many crop-livestock systems, the birth of twins or even triplets may result in substantial increases in productivity.

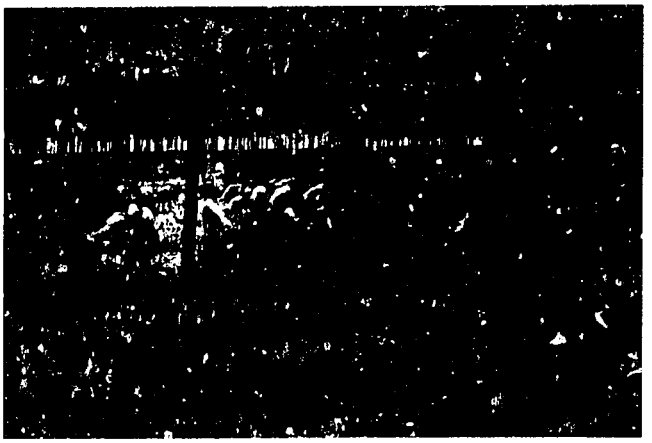
In 1981, a breeding project on prolific sheep was started in Indonesia. The project focused on three major issues related to prolificacy. The first evaluated the mode of inheritance of prolificacy in populations of local sheep. The second examined the genetic potential for improvement of additional production traits. Lastly, the development of suitable breeding and production technologies for prolific animals was investigated. This research was conducted on the experimental sheep flock at Cicadas, West Java in a climate typical of the humid tropics. The results indicate that prolificacy in JTT sheep apparently involves a "major" gene, tentatively designated F j.

Research on prolificacy has produced breeding stock which will now be tested under various field conditions to determine the optimum levels of prolificacy as well as to establish high and low prolificacy lines. Concurrently, more knowledge in management and nutrition of prolific animals is being generated which emphasizes the utilization of local agricultural by-products and strategic nutritional supplementation.

Determination of the mode of inheritance in Javanese sheep is an important achievement for the SR-CRSP from two viewpoints : (1) it defines the basis for development of breeding stock with optimal levels of prolificacy for a range of environments and, (2) it contributes directly toward meeting the challenges imposed by the research goal to intensify the already intensive production system. There are some areas in Java that are presently shifting toward more specialized farms to produce lambs. This strategy is complemented by production schemes which raise weaned lambs or feedlot animals for market. The work has helped identify and characterize valuable genetic resources with direct implications for sheep production in the humid tropics.

Integrated Tree Cropping with Sheep Production

In 1985, the SR-CRSP and RIAP, initiated a research project on integrated production systems involving sheep and rubber plantations. This project was based in Sei Putih, near Medan, North Sumatera. Initially aimed at exploring the potential use of the forage found in rubber plantations, the project has now developed into research on developing an integrated production system. It will continue to be the main research component of the SR-CRSP in Indonesia beyond 1990.



Sheep grazing under rubber trees in North Sumatera

Plantation crops, in general, represent an important potential for the development of mutually beneficial production alternatives based on livestock exploitation. A cover crop, typically of legumes, is established along with the planting of young rubber trees to minimize the presense and effect of weeds, and to incorporate nitrogen into the soil. Introducing plants that can also be utilized in the diet of ruminants is a possible component of tree plantation management. Therefore, the understory vegetation of the tree crops becomes the source of fresh forage for the livestock production system. Moreover, sheep that graze under plantation crops are beneficial for the control of weeds.

Integrated Production

There are approximately 10 million Ha of land under plantation crops in Indonesia as shown in Table 2. Rubber alone accounts for over 3 million Ha, primarily distributed on the Island of Sumatra. The production potential of this area of land has motivated the development of the RIAP/SR-CRSP program in North Sumatra.

Table 2. Tree crops in Indonesia

Crop	Million/Ha
Rubber	3.11
Oil palm	3.32
Coffee	0.96
Coconut	1.02
Clove	0.76
Other[1]	1.40

[1] Includes crops produced on less than 0.5 million/ha.

Research on integrated production of tree crops and sheep is a relatively new activity. It involves a multidisciplinary approach to confront the specific production aspects of these associated environmental niches. In particular, for the production system to succeed, it is necessary to introduce a well adapted animal which will take full advantage of the year-around production of fresh forages to reproduce at an intensive rate. Experimental data obtained at Sei Putih identified the Sumatran Thin Tail sheep (STT) as a suitable animal for integration with tree crops, particularly rubber. In spite of its small size (22 kg adult body weight), the STT is a highly productive animal producing at a rate of 3 lambings every 2 years with an average litter size of 1.54 lambs per lambing.

Breeding Program for Sumatran Sheep

The SR-CRSP/RIAP program has simultaneously implemented two plans to increase the body weight of STT. One plan is based on the establishment of a nucleus flock for selection for body weight, milk production and wool cover. The second plan involves the introduction of hair sheep from the humid tropics which also has the potential to reproduce year-around.

Saint Choix, Local and Crossbred rams.

In 1986, a flock of white Saint Croix Sheep from the Virgin Islands was used to cross local STT under a controlled environment. The resulting hair sheep, as the name indicates, have little or no wool and are heavier than STT sheep. STT sheep have considerable variation in wool cover with a significant proportion of the animals having coarse and irregular fleece. Evidence suggests that hair sheep may have some adaptation advantages compared to wooled animals in hot and humid environments.

Preliminary results indicate that crossbred lambs have increased growth performance relative to STT sheep as indicated in Table 3. These results, however, tell little of the adaptation of the Saint Croix genotype to the environmental niches under rubber trees. Reproductive performance of crossbred ewes compared to STT as well as information on lamb and adult survival rates are necessary to assess the adaptation of the Saint Croix and the possible increases in value due to this cross. On-going evaluations of reproductive performance, (Table 3), seem to indicate that the Saint Croix sheep is, potentially, a suitable breed to improve the STT.

Table 3. Production performance of Sumatran Thin Tail (STT) and their Crosses with the Saint Croix hair sheep (SC)

Production trait	STT	STT x SC	3/4 SC
Adult Body wt. (kg)	22.0	28.8	n.a.
Birth wt. (kg)	1.8	2.2	2.3
Weaning wt. (kg)	9.3	10.8	11.5
Litter size	1.54	1.35	n.a.
Lambing interval (days)	201	222	n.a.

n.a. = information not available.

Feeding systems

The SR-CRSP/PIAP production scheme in Sei Putih is a modification of the traditional system in order to raise sheep in much larger numbers with forage from rubber plantations. The animals are housed at night in raised barns with slatted floors and allowed to graze under rubber trees from 8:00 - 16:00 hrs.

Improved feeding sy tems research is conducted to determine the optimum grazing pattern.

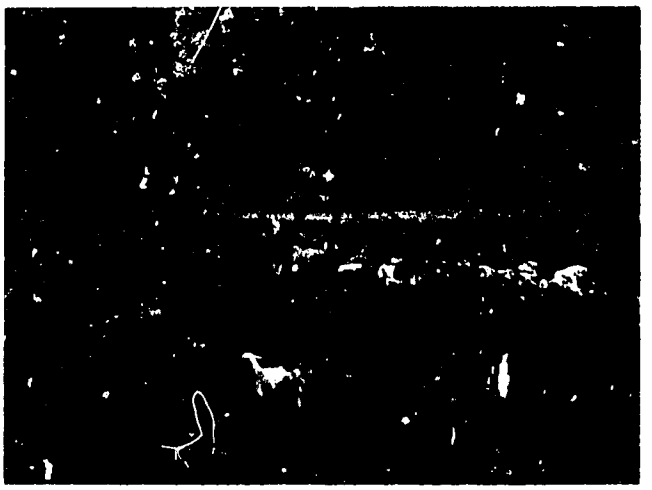
Experiments are being conducted to determine the optimum grazing systems including optimum stocking rates and rotational grazing patterns.

As Table 4 indicates, it was determined that supplementation with higher levels of energy reduces the lambing interval by about 25 days, and increases the overall production of ewes estimated as kg of lambs weaned.

Table 4. Productivity of Sumatran Thin Tail sheep receiving continuous supplementation to grazing forages under rubber trees.

	Production trait	
% supplement on body wt basis[a]	Lambing interval (days)	Kg of lamb per ewe/year
0	219	19.0
1.0-1.4	194	24.0

[a] Supplementation to grazing.



Basal diets for sheep grazing under rubber trees include native grasses and legume cover crops.

Aimed at producing results that are both technically and economically feasible, studies on supplementation have included: 1) strategic supplementation of ewes during different physiological stages, and 2) the utilization of agricultural by-products, specially from rubber and oil-palm trees and sugar cane (molasses) (Table 5).

Table 5. Growth rate ranges (gr/day) of STT and STT crossed with the Saint Croix sheep (SC) lambs.

Type of supplement	STT	STT x SC	3/4 SC
Control (no supplement)	45 - 63	48 - 68	80 - 83
Molasses/broken rice	54 - 61	54 - 61	–
Cassava/molasses/fishmeal	52 - 72	100 - 132	51 - 120
Palm kernel cake (PKC)	83 - 103	–	112 - 117
PKC/rice bran/molasses	75 - 80	85 - 93	–
Rubber seed	70 - 82	–	–

This research is being conducted in conjunction with studies exploring alternatives for improving the quality of forage by introducing and testing new forages, including shade-tolerant species.

Indonesian Small Ruminant Network

In October 1988, the collaborative program between the SR-CRSP and RIAP organized and funded a meeting to evaluate the needs of a communication network between various institutions involved in small ruminant production in Indonesia. Twenty institutions, a record number, participated in this event, highlighting the increasing interest in small ruminant production. Dr. Joel Levine, former SR-CRSP resident scientist in Bogor, contrasted the present situation with that at the beginning of the last decade : "Ten years ago a meeting of this type would have brought together no more than five institutions."

Representatives from the different institutions and agencies expressed their concerns about serious gaps in communication and information exchanges concerning small ruminant production. These gaps have resulted in the inefficient utilization of available resources, lack of inventories of institutional and human resources, and the slow dissemination of information from the research level to the end user. A proposal for a network to promote communication and to assist the development of small ruminant production in Indonesia emerged from this event.

To date, networking activities have included ;

One of the goals of the research, development and information exchange process is to increase the productivity and production of small ruminants.

(1) the publication of the proceedings of the October, 1988 meeting; (2) the organization of a literature data bank, including more than 1,000 entries and; (3) publication of a directory of institutions and individuals in the area of small ruminant production; and; (4) publication of the first twice-a-year newsletter.

Networking activities have also included coordinating an animal health survey which identified traditional health management practices as part of an effort to catalog indigenous and low-cost health maintenance techniques for SR production systems.

The Indonesian Small Ruminant Network (ISRN) will play a major role in the activities of the SR-CRSP in the years to come. It is intended to be the dissemination and linking mechanism for the research and production activities designed to increase the income of the many smallholder farmers raising sheep and goats in Indonesia.

Future Directions for the SR-CRSP in Indonesia

Programmed to be terminated in 1990, after an operational period of 10 years, the SR-CRSP was recently granted an extension for an additional 5 years

by USAID. This makes the SR-CRSP one of the longest running assistance programs in USAID's history.

The basis for this extension included; the relevance and applicability of the RIAP/SR-CRSP work on small ruminant production in the humid tropics; the need to integrate research results obtained over the past ten years into more specific recommendations for impacting farmer incomes, and the outstanding collaborative framework and research atmosphere developed by Indonesian and SR-CRSP counterpart scientists.

In this new phase, to begin October 1990, the SR-CRSP proposes to concentrate on the following general activities :

1. **Intensive production systems (West Java).**

Completion of research project on prolific sheep, involving :

- Progeny tests of prolific rams and breed improvement in production systems distributed throughout Java.
- Determination of nutritional and managerial strategies for prolific sheep.
- On-farm research on intensive, commercial oriented, production systems.

The prolific nature of Indonesian sheep offers significant potential for future expansion of production.

2. **Integrated tree cropping production systems, North Sumatra.**

Development of an integrated tree cropping and sheep production systems based on :

- an adapted and improved hair sheep strain.
- nutrition management strategies matching available feed resources.
- sustainable feed production strategies.
- health management systems including genetic resistance to parasites.
- On-farm evaluation and validation, particularly with the inclusion of smallholder farmers and integrated commercial schemes.

3. **Training of SR professionals and continued human resource development.** Both academic and short-term courses at home and abroad.

4. **Continued development of the Small Ruminant Network.**

- Information exchange and collaborative research efforts between Indonesian research organizations and international programs.

The development of the research activities during the extended period of the project provides new challenges for the SR-CRSP program. There is increasing momentum for improvements in small ruminant production in Indonesia and neighboring countries, mainly dictated by increasing market demands. The potential provides well grounded confidence for continued progress for farmers and scientists to collaborate as partners in productivity.

Increased productivity for the smallholder farmers can improve farm family welfare and income from raising sheep and goats.