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Technology Transfer: Development of Peanut Processing in Huay-Bong-Nua Village, Thailand

PEANUT COLLABORATIVE RESEARCH SUPPORT PROGRAM

On the cover:
Women-farmers and family members sort peanut for processing and marketing in Huay-Bong-Nua village, Prao district, Cheingmai province, northern Thailand.

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Technology Transfer: Development of Peanut Processing in Huay-Bong-Nua Village, Thailand

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ABSTRACT

This research was conducted in 1991 and 1992 to investigate the transfer of peanut processing technology, along with business and marketing management, to farmers in Huay-Bong-Nua village, Prao district, Cheingmai province, northern Thailand. A conclusive study of the effect of this technology on the socioeconomic status of these farmers was not possible due to the short time period, but certain preliminary results may be inferred.

A pilot group of seven women farmers was formed to process peanut products for the downtown Cheingmai and Prao district markets. All necessary equipment and materials were purchased and set up at the project site. The women were trained in the techniques for processing and quality control of both oil roasted and ground roasted peanut, as well as in business management and product marketing. (Oil roasted peanut is partially dry roasted, then completed in hot oil; ground roasted peanut is dry roasted, then ground into flour.) On-site activities were monitored monthly, thus providing a means for discussing and solving any problems that might be incurred. The quality of the products processed was evaluated before shipping to markets, and shelf life was determined. Finally, a socioeconomic evaluation of the group was initiated.

The processed peanut products contained no aflatoxin, no defects, and low microbial contamination. Consumer acceptability of both products was high, especially of the ground roasted peanut which had better quality than others already available in the markets. These results revealed that the women were well trained and understood the techniques in processing both oil roasted and ground roasted peanut. The shelf life of both products was short, however: about 6 weeks for oil roasted peanut and 4 weeks for ground roasted peanut. High temperatures and unsuitable packaging caused the products to become rancid, which resulted in product rejection.

Total cost for oil roasted peanut was 43.44 Bahts/kg and for ground roasted peanut 17.20 Bahts/kg. Retail price for oil roasted peanut was 100 Bahts/kg and for ground roasted peanut 30 Bahts/kg. Commission to shopowners was 20% of the retail price. Net profit was 36.56 Bahts/ka for oil roasted peanut and 6.80 Bahts/kg for ground roasted peanut. Because of the demand for and turnover rate of the flour, we recommended that the farmers concentrate on processing ground roasted peanut.

Improvement in socioeconomic status of the producer group appears promising, although the project was conducted for only 6 months, which is a very short time for definitive change. Nevertheless, the women learned techniques for processing peanut products, for business management, and for marketing management, all of which will help them improve their quality of living. In fact, during the 6 months following the end of the project, the group of women earned a monthly profit of at least 1088 Bahts by selling ground roasted peanut in the Prao district market alone.

Note: This report uses the local terms *rai* for land and *Baht* for money throughout. For comparison: 6.25 rai = 1 ha; 2.5 rai = 1 acre; 25 Bahts = $1.00 U.S

INTRODUCTION

Research on Appropriate Technology for Storage and Utilization of Peanut, funded by the Peanut CRSP, has been conducted in Thailand, as well as in other countries, for the last 10 years. Part of the Thai research has focused on improvement in quality of many traditional peanut products, along with development of some new ones. The program is maturing, and technologies developed by Peanut CRSP researchers are now being transferred to end users--that is, to small and mid-scale industries. This is the first project in transferring technology to a rural area, Huay-Bong-Nua village, Prao district, Cheingmai province, northern Thailand. The project was conducted in 1991 and 1992.

Huay-Bong-Nua village is in the northeastern part of Cheingmai province, about 90 km from downtown Cheingmai. The total area is 3895 rai. It is a newly developed village for poor farmers who previously had no land, designated by the country as an Agricultural Cooperative Park. Each family occupies about 10-20 rai for living and for farming of crops, livestock, and fisheries. Almost all the area is used for the main crop, rice, in the rainy season. Peanut is the second crop, occupying about 80% of the total area throughout the growing season. In 1992 the total population was 658 adult villagers, of which 316 were men and 342 were women; the total number of households was 193 families.

The Department of Product Development, Kasetsart University, joined with the Department of Agricultural Economics, Kasetsart University, and the Department of Food Science and Technology, Cheingmai University (with the cooperation of the Department of Food Science and Technology, The University of Georgia, USA) to conduct this research to investigate the possibility of transferring peanut processing technology to farmers in Huay-Bong-Nua village, Prao district, Cheingmai province, northern Thailand. A primary interest was the effect of such transfer on their socioeconomic status.

MATERIALS AND METHODS

Socioeconomic and Marketing Surveys

Before initiating the processing technology transfer study, we conducted a survey of socioeconomic status of 50 farm households in Huay-Bong-Nua village using a direct interview questionnaire. Questions were asked in the following areas: general information, farming practices, economic status, and marketing status, especially for peanut.

A preliminary evaluation of the socioeconomic status of the group of seven women in the project (see below) was done by observation and by interviewing them at the end of the project (6 months) and after a year.

We also conducted an informal survey at several markets in Cheingmai to identify the most popular peanut products. These products were purchased and analyzed for aflatoxin content. The aflatoxin content and other quality and shelf-life factors of the processed peanut were then determined and compared with the existing products as a means of validating the group's learning of the processing technology. The survey was conducted on information from the 1990-1991 crop season.

Technology Transfer Processes

The technology transfer research was conducted in 1991 and 1992; this report was completed in October 1992.

A pilot group in the village was asked to form to join this research activity. The district home economist was invited to serve as group advisor. Table 1 lists the group members.

Table 1
Pilot group members in the peanut processing technology transfer project, Huay-Bong-Nua village, Thailand, 1991-1992.

Name	Position	Occupation
Mrs. Niratana Rom-Keaw	Advisor	District home economist (govt. official)
Mrs. Srinual Tidchai	Chairlady, Marketing Mgr.	Farmer
Mrs. Umpha Ngou-Sai	Coworker	Farmer
Mrs. Nor Buaklee	Coworker	Farmer
Mrs. Wan Pundit	Coworker	Farmer
Mrs. Buaphan Bhudpha	Coworker	Farmer
Mrs. Chantra Wannaluk	Coworker	Farmer
Mrs. Pongwan Chailungka	Coworker	Farmer

A manual for processing the targeted peanut products was prepared by the Department of Product Development, Kasetsart University. Information included methods for screening for good-quality peanut, grading, cleaning, blanching, frying, grinding, and packaging of both oil roasted and ground roasted peanut. Oil roasted peanut is partially dry roasted, then completed in hot oil; ground roasted peanut is dry roasted, then ground into flour. Fig. 1 is a flow diagram of the processes involved.

PRODUCTION PROCESSES

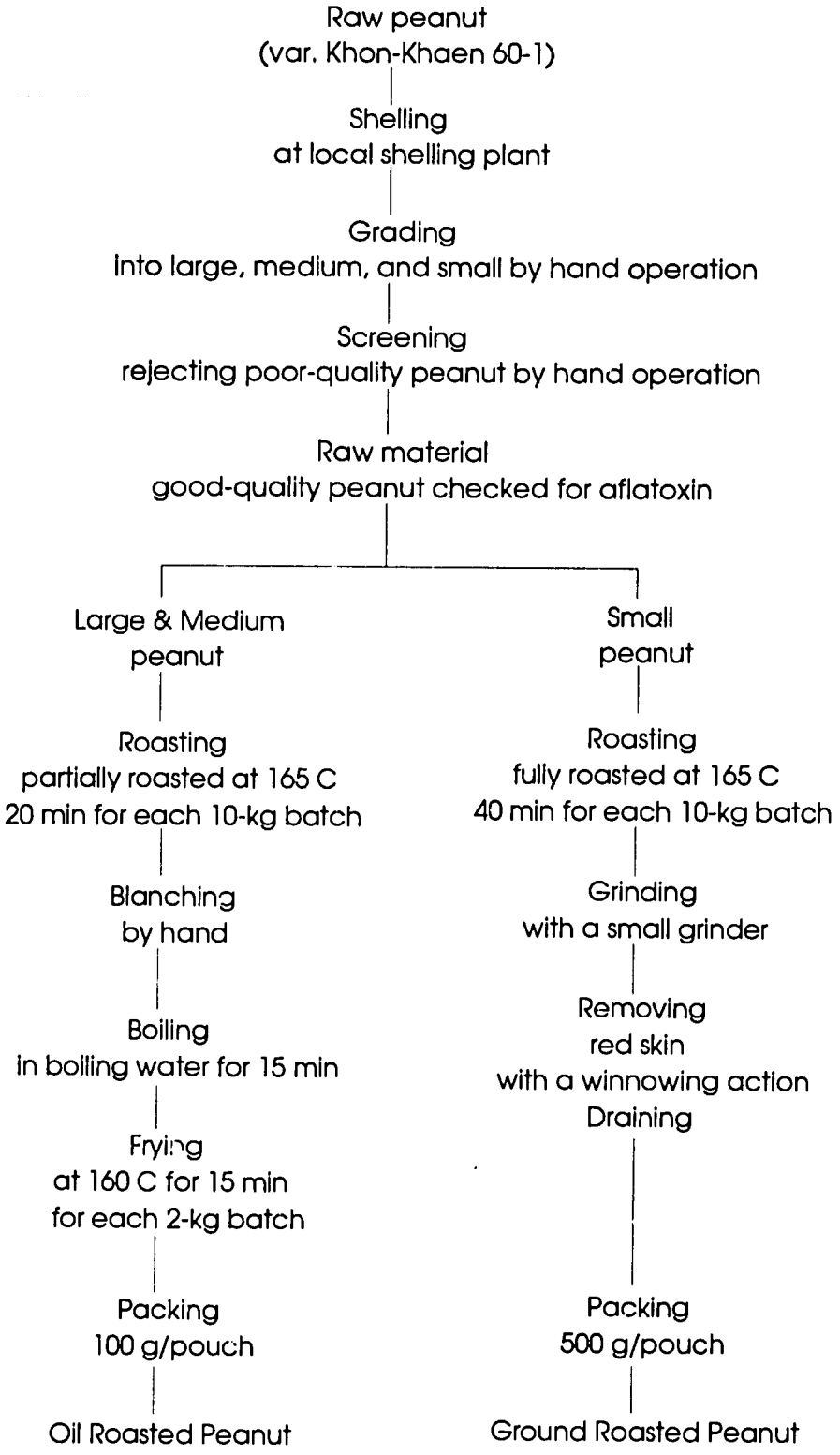


Fig. 1 Production processes of oil roasted (left) and ground roasted (right) peanut.

Small equipment and materials were purchased and delivered to the village. This included a hand roaster of 20 kg capacity, an LPG gas burner as a source of energy, a set of frying pans, a grinder, a plastic sealer, scales, plastic pouches, labels, and trays.

Using the prepared manual and hands-on activities, we conducted training in processing techniques and marketing activities at the village. This took two days. After the group learned the techniques, they began their own production of oil roasted peanut from large peanut seeds and of ground roasted peanut from medium and small peanut seeds. The products were sent to the markets in downtown Cheingmai and in Prao district. The women were also taught to keep records of expenses and income.

Every month we visited the site to observe the processing and to discuss and help solve any problems. One graduate of the Department of Product Development was stationed in downtown Cheingmai to cooperate with the group as required.

Evaluation

Of quality. Samples of the products were taken for evaluation of quality by a student who had graduated from the Department of Product Development. Quality evaluation was performed in the laboratory at the Department of Food Science and Technology, Cheingmai University. Both microbial loads and aflatoxin content were measured.

Of shelf life. Samples of oil roasted and ground roasted peanut were taken before marketing and were stored at room temperature for 2 months. Moisture content, water activity, and peroxide value of the products were analyzed every week. Analysis was performed in the laboratory at the Department of Food Science and Technology, Cheingmai University.

Of consumer acceptance. Oil roasted peanut produced by the group was tested for acceptance by 100 consumers. Consumers were asked to rate the product on size, color, texture, and flavor using a 9-point hedonic scale. Because ground roasted peanut is used as an ingredient in several commercial Thai foods, we invited 47 caterers--30 males and 17 females--to evaluate the group's product.

Socioeconomic Status of Farmers

Demographic information of 50 farm households in Huay-Bong-Nua village who grew peanuts is shown in Table 2. Three out of four people were farm workers. Both women and men were farmers, at a ratio of 1:1. Of the total population, 54.47% worked full-time on their own farms, and 39.84% worked part-time both on their own farms and in other jobs in the village; 5.69% did not work on the farm at all (Table 3). About 88% of the households owned their own land.

Table 2
Demography of selected peanut growers in Huay-Bong-Nua village, 1990-1991 crop season, before introducing peanut processing technology.

Item	Total	Male	Female
No. of farm households	50		
Age of head of household (years)	43.16		
Education (%)			
Illiterate	2		
Primary school (grade 1-4)	90		
Primary school (grades 5-6)	4		
Secondary school	4		
Family size (avg. no. of persons)	3.52	1.64	1.88
Full-time farm and nonfarm workers in family (avg. no. of persons)	2.32	1.10	1.22
Part-time workers in family (avg. no of persons)	0.08	0.02	0.06

Table 3
Working conditions of household members in Table 2, 1990-1991 crop season.

Item	No. of laborers	% of total
Nonfarm labor (did not work on farm)	7	5.69
Part-time labor (worked part-time on farm)	49	39.84
Farm labor (worked full-time on farm)	67	54.47
Total	123	100.00
Type of nonfarm and part-time work		
Farming	36	64.29
Construction	8	14.29
Tractor driving	3	5.36
Tobacco grading	3	5.36
Hire labor (miscellaneous)	2	3.57
Other	4	7.14
Total	56	100.00
Working location of nonfarm and part-time work		
Within village	50	89.28
Other district	5	8.93
Other province	1	1.79
Total	56	100.00

Many different crops are grown in the village, including rice, peanut, soybean, mungbean, blackpea, corn, and chile. Fig. 2 shows peanut in multiple-cropping systems year round.

Land use for growing peanut was 5.76 rai, which was about 45% of the total land per household (Table 4). Each household earned about 6388 Bahts/year from selling peanut, which was about 33% of the total income of almost 19,500 Bahts/year (Table 5). The greatest household expenditure was for food, just over 10,800 Bahts/year, which was about 68% of the total expenses of almost 16,000 Bahts/year (Table 5).

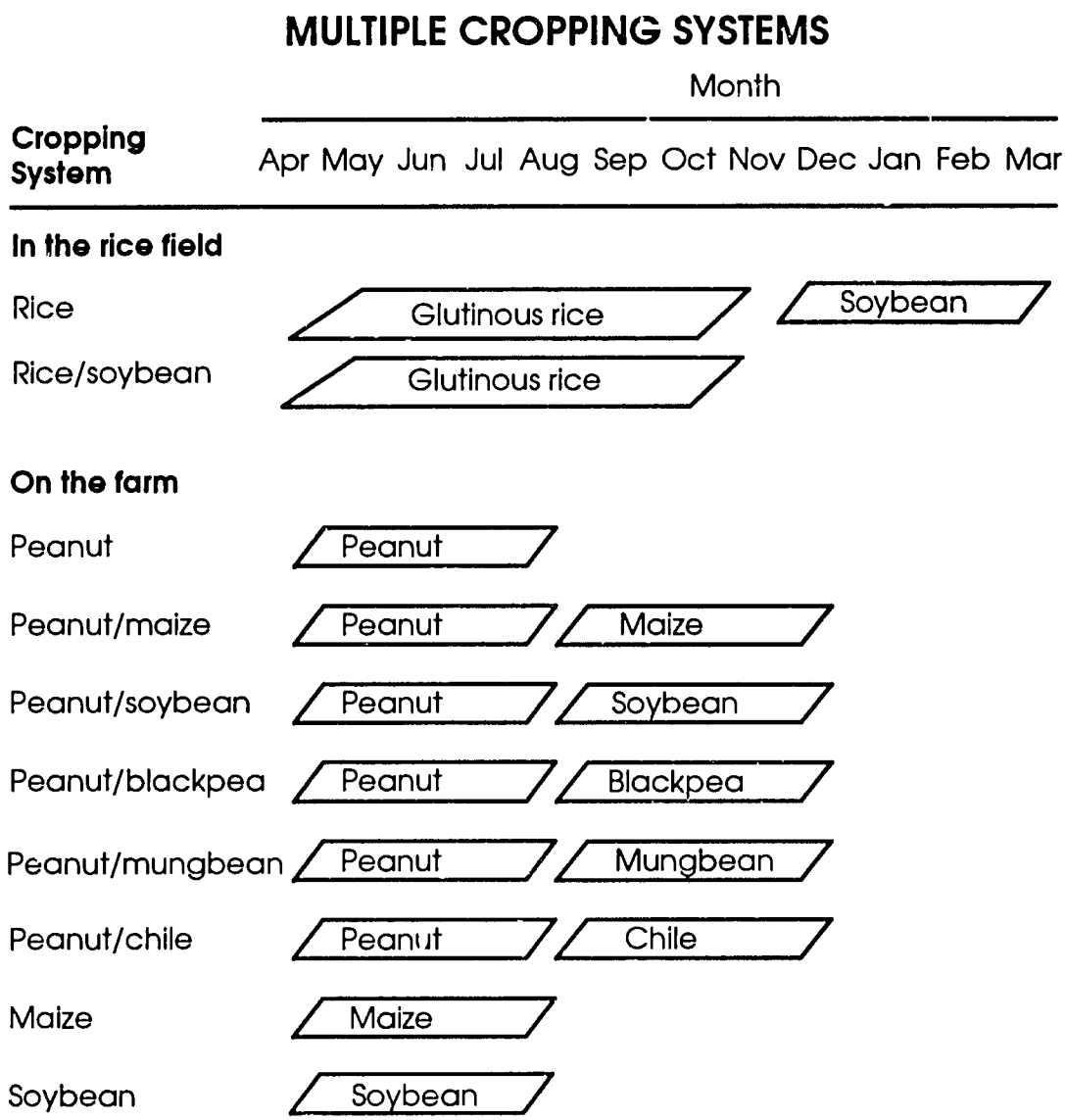


Fig. 2 Multiple-cropping systems, most including peanut, year round in Huay-Bong-Nua village, Thailand, in 1990-1991.

Table 4
Land use for farming, Huay-Bong-Nua village, Thailand, 1990-1991 crop year.

Crop	Planted area (rai/household)[a]	% of total
Peanut	5.76	45.04
Chile	2.34	18.30
Maize	1.89	14.78
Soybean	1.50	11.73
Rice	1.16	9.07
Blackpea	0.35	0.78
Mungbean	0.32	0.31
Total	13.32	100.00
Cropping intensity	1.07	

a. 2.5 rai = 1 acre.

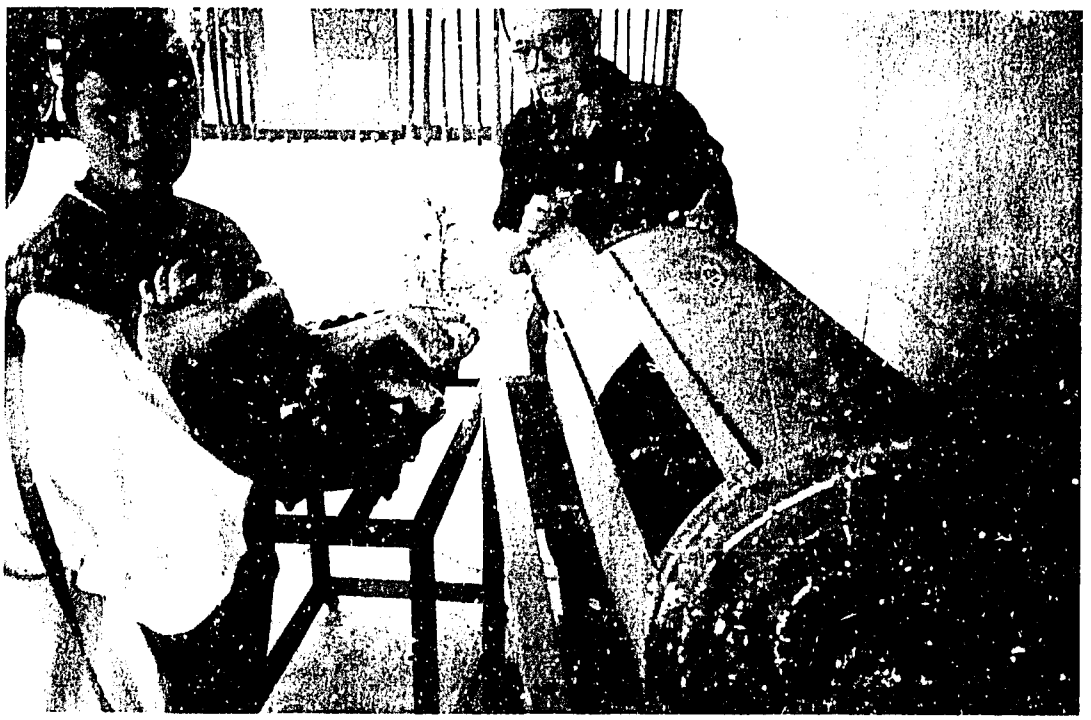
Table 5
Cash farm income and expenses, per household, 1990-1991 crop year.

	Amount (Baht)[a]	% of total
Income		
Peanut	6,387.71	32.91
Chile	2,246.60	11.58
Maize	1,453.08	7.49
Soybean	998.59	5.14
Blackpea	117.40	0.60
Mungbean	48.00	0.25
Hire labor (off-farm)	8,157.20	42.03
Total	19,408.58	100.00
Expenses		
Food	10,815.28	67.61
Clothing	1,271.80	7.95
Medicine	881.40	5.51
Festivals	1,024.80	6.41
Miscellaneous	2,003.40	12.52
Total	15,996.68	100.00

a. 25 Baht = $1.00 in 1991.

Cost of peanut production per rai was 2050 Bahts, of which 96% was for variable costs and 4% was for fixed costs; cash farm expense was 798 and noncash farm expense was 1252 Bahts/rai (Table 6). A total of 72% of the farm expenses came from the farmers' savings and 28% was borrowed from the Cooperative and Agricultural Bank.

Table 7 shows average production costs and net income of peanut production per rai at Huay-Bong-Nua village before this study. Production yield averaged 225 kg/rai; selling price of the peanut was 9.39 Bahts/kg. Therefore, net income averaged 1882 Bahts/rai. Although net return was -89 Bahts, net profit over cash farm expense was 1084 Bahts. From Table 8, which shows the net profit of peanut and other crops, it is clear that peanut growing gave the highest net profit. These data also show that farm processing and sale of a value-added product is important for increasing farm income.



Project scientists instruct a woman-farmer in the operation of the peanut roaster used for processing roasted and ground peanut.

Table 6
Cost of peanut production per area (Bahts/rai), Huay-Bong-Nua village, Thailand, 1990-1991 crop year.

	Noncash	Cash	Total	% of total
Variable cost				
Labor (planting to harvest)				
Seed preparation	161.17	10.80	171.97	8.39
Land preparation	79.97	5.43	85.40	4.17
Plowing	6.45	102.11	108.56	5.30
Digging	109.08	66.69	175.77	8.58
Handweeding (1)	296.26	179.73	475.99	23.22
Handweeding (2)	100.85	4.07	104.92	5.12
Pesticide application	2.58	0.81	3.39	0.16
Fertilizer application	3.98	0.68	4.66	0.23
Harvesting	150.42	110.73	261.15	12.74
Depodding	11.54	229.97	241.51	11.78
Total	922.30	711.02	1633.32	79.69
Materials and supplies				
Seeds	251.63	--	251.63	12.28
Chemical fertilizer	--	80.87	80.87	3.95
Pesticide	--	4.81	4.81	0.23
Maintenance	--	1.07	1 07	0.05
Total	251.63	86.75	338.38	16.51
Total variable cost	1173.93	797.77	1971.70	96.20
Fixed cost				
Equipment deterioration	3.39	--	3.39	0.17
Land use	72.50	--	72.50	3.54
Opportunity loss	1.99	--	1.99	0.10
Total fixed cost	78.88	--	77.88	3.80
Total cost	1251.81	797.77	2049.58	100.00

Table 7
Net investment and return of peanut production in Huay-Bong-Nua village, Thailand, 1990-1991 crop year.

	Value
Yield (kg peanut/rai)	225.52
Average price (Bahts/kg)	9.39
Income (Bahts/rai)	1882.27
Variable cost (Bahts/rai)	1971.70
Fixed cost (Bahts/rai)	77.88
Total cost (Bahts/rai)	2049.58
Total cash cost (Bahts/rai)	797.77
Net return (Bahts/rai)	-89.43
Net profit over cash cost (Bahts/rai)	1084.50
Net profit over total cost (Bahts/rai)	-167.31

Table 8
Comparison of net profit over cash in various crops, Huay-Bong-Nua village, 1990-1991 crop year.

Crop	Net profit over cash
Peanut	1084.50
Chile	962.14
Maize	768.82
Soybean	667.95
Blackpea	335.43
Mungbean	150.00

Marketing Status

In Thailand, as in developing countries, marketing of farm produce is a primary production problem. Farmers cannot sell their products at a fair price. Total profit is shared among farmers and the various middlemen merchants involved in sales. Table 9 illustrates the marketing conditions for peanut in the village.

Table 9
Peanut marketing conditions in Huay-Bong-Nua village, Thailand, 1990-1991 crop year.

	No. of farmers (*N* = 50)	% of total
Selling form		
Fresh pod	0	0
Dried pod	50	100
Type of merchant		
Inside village	19	38
Outside village	31	62
Location of sales		
Inside village	50	100
Outside village	0	0
Marketing problem		
None	20	40
Low price	27	54
Low quality	3	6

Oil-roasting of peanut by one of the project participants.

RESULTS AND DISCUSSION

Marketing Alternatives

Farmers sold dried peanut in the shell to both village traders (38%) and outsiders (62%). Although 40% of farmers said they had no problem marketing their crop, 54% wanted higher prices and only 6% said their products did not meet quality requirements. Nevertheless, the demand for in-shell peanuts is small, and peanut is often overproduced. Processing peanut in the village would enable farmers to grow more peanuts to meet an increased demand. Also, income should increase by marketing a value-added product rather than raw peanut.

Alternatives for processed products included coconut- or coffee-coated peanut, dried roasted peanut with pods, steamed and dried peanut with pods, oil roasted peanut, and ground roasted peanut. Because the most popular consumer product in Cheingmai province is oil roasted peanut and because ground roasted peanut is a popular ingredient in cooking many Thai dishes, we selected them for the technology transfer project.

Costs of the Processing Technology

Production costs for oil roasted and ground roasted peanut in this project are shown in Table 10 (next page). For both techniques, the greatest expense was for the raw material (peanut). Selling price for the oil roasted peanut product was 100 Bahts/kg and for the ground roasted peanut product 30 Bahts/kg. Thus, profit of the oil roasted peanut was 36.56 Bahts, or 84.16% of the cost; of the ground roasted peanut it was 6.8 Bahts, or 39.53% of the cost.

Quality and Shelf-Life

A major problem in this area is the high level of aflatoxin contamination in ground roasted peanut sold in the Cheingmai markets: more than 90% of peanuts are contaminated with high levels of aflatoxin that range from 0 in the Warorot markets to 2039 ppb in the San Pa Koi markets. The average of peanut in 22 market locations in the province is 541 ppb of aflatoxin contamination. (Maximum aflatoxin allowed in U.S. peanut is 20 ppb.) We considered aflatoxin reduction an essential part of the project.

Microbial quality and aflatoxin content of the oil roasted and ground roasted peanut from the group was either low or nonexistent (Table 11).

This proved that the group could follow the procedures and understand the techniques very well.

Table 10
Processing costs of oil roasted and ground roasted peanut, Huay-Bong-Nua village, 1991-1992.

Item	Expense (Baths/kg)	% of total
Oil roasted peanut		
Peanut	26.32	60.59
Fuel	1.23	2.83
Packaging, labeling	4.00	9.21
Edible oil for frying	1.37	3.15
Labor	10.52	24.22
Total	43.44	100.00
Ground roasted peanut		
Peanut	12.57	73.08
Fuel	1.07	6.22
Packaging, labeling	0.70	4.07
Labor	2.86	16.63
Total	17.20	100.00

Table 11
Quality of oil roasted and ground roasted peanut processed by farmers at Huay-Bong-Nua village, 1991-1992.

Quality factor	Oil roasted	Ground roasted
Microbial quality		
Total count (colonies/g)	420	750
Yeast and mold (colonies/g)	--	45
Coliform (MPN/g)	--	2
Aflatoxin	ND[a]	ND

a. ND = not detected.

The results of the storage (shelf-life) test of oil roasted peanut in plastic pouches are shown in Table 12. Moisture content and water activity were both low initially, but increased rapidly from 5 to 8 weeks; the average rate of moisture content increase was 0.034% per week. This greatly affected the crispness and rancidity of the processed peanut. The peroxide value (measure of rancidity) in the oil roasted peanut increased steadily over the entire period, with an average of 3.25 meq/kg oil per week. The rapid increase in peroxide value was due to the plastic pouch packaging, which did not prevent air from entering, and to the extremely high temperatures in the market. Thus, the shelf life of oil roasted peanut packed in plastic pouches in no longer than 6 weeks; after 6 weeks it is rejected by consumers due to rancidity.

The results of the storage test of ground roasted peanut in plastic pouches are also shown in Table 12. Moisture content and water activity increased rapidly at 3 weeks and continued to be high through 8 weeks; the average rate of moisture content increase was 0.028% per week. The peroxide value in the ground roasted peanut also increased steadily over the entire period, with an average of 4.0 meq/kg oil per week. Shelf life of ground roasted peanut is 4 weeks. Because ground roasted peanut is a wholesale product destined for food caterers, its market is more certain, so shelf life does not appear to be a problem.Packed in bags of 500 g, the product is generally used within a week.

Further research should be done to develop better, cost-effective packaging procedures.

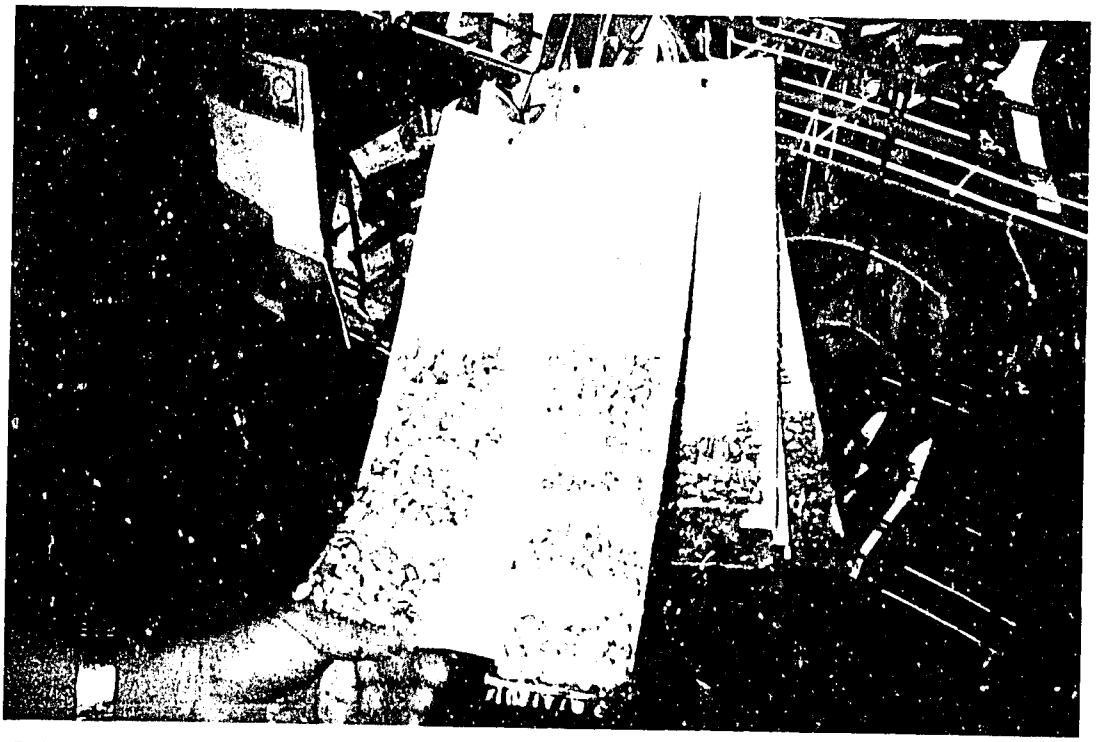
Table 12
Effect of storage time on moisture content, water activity, and peroxide value of oil roasted and ground roasted peanut.

	Time (weeks)								
Value	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Oil roasted									
Moisture content (%)	1.22	1.29	1.31	1.28	1.29	1.32	1.43	1.41	1.49
Water activity	0.26	0.26	0.27	0.26	0.27	0.28	0.28	0.29	0.29
Peroxide value (meq/kg)	2	5	11	14	18	18	24	27	29
Ground roasted									
Moisture content (%)	2.26	2.28	2.33	2.44	2.42	2.43	2.46	2.58	2.59
Water activity	0.33	0.33	0.34	0.35	0.34	0.34	0.35	0.35	0.36
Peroxide value (meq/kg)	2	8	12	14	18	23	29	33	35

Consumer Test

Fig. 3 shows the results of a consumer test for oil roasted peanut at Cheingmai market near the end of the project. A total of 100 consumers, 42 male and 58 female, were interviewed. Most of them liked the peanut product due to its texture, taste, and aroma; sensory scores were moderately high to high, from 6.44 to 7.17. Highest score was for the crisp texture.

Of the respondents, 55% accepted the product, 11% would not accept it, and 34% were unsure. A total of 88% considered the packaging size suitable, but 8% thought it was too small. About 89% thought the price of 5 Bahts/50 g package was adequate. Some 41% of the consumers suggested adding a small amount of salt to improve the taste.



Oil-roasted peanut packaged, attached to cards and presented for sale in a local market.

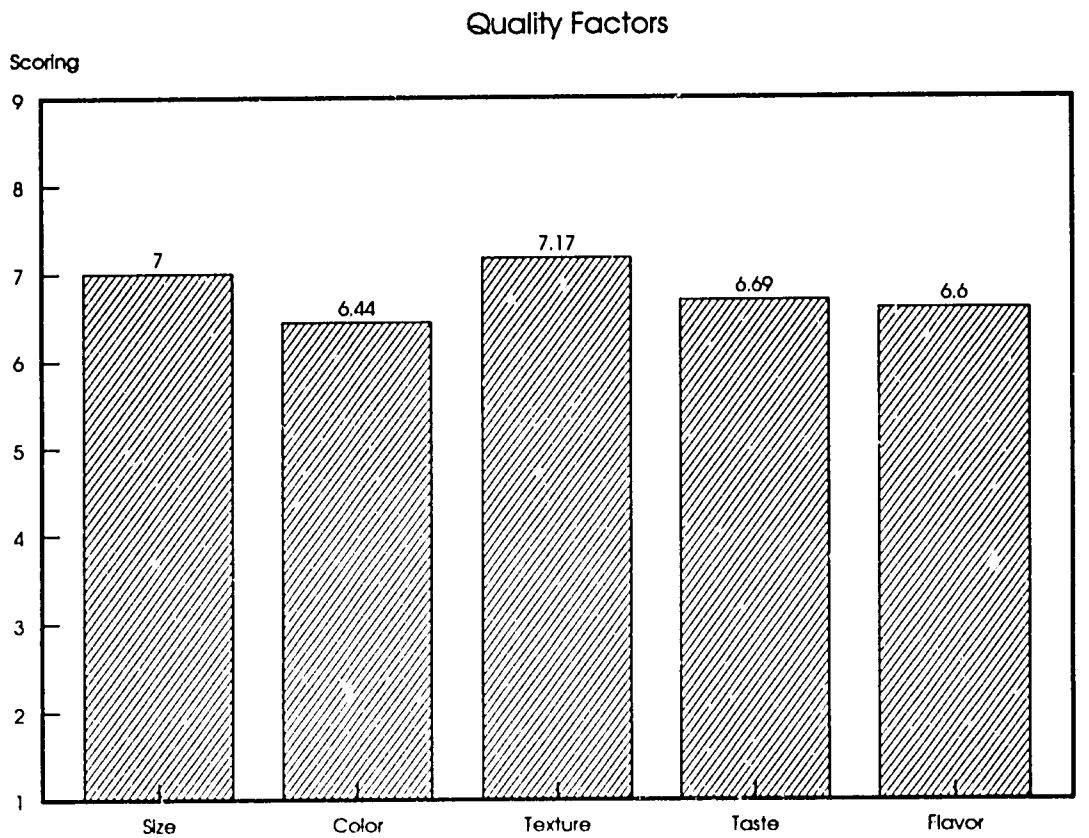


Fig. 3 Consumer rating (based on a 9-point hedonic scale) of oil roasted peanut produced by the farmer group at Huay-Bong-Nua village, 1990-1991.

The caterers who used the ground roasted peanut were also interviewed for their ratings. There were 30 males and 17 females, ranging from 20 to 50 years of age, with 45% of them over 40 years old. The foods for which they used ground roasted peanut included fried noodle and special sweet and sour noodle (i.e., Tom-Yam), 90%; satae sauce, 5%; and other foods, 5%. About 75% of them used from 500 to 1000 g ground roasted peanut per day. About 7% of them preferred to buy the product rather than make it themselves. The caterers who made their own product were mostly concerned with freshness and cleanliness of the product, along with sanitary processing conditions; they did not trust the quality of the usual products sold in the markets. About 95% of the caterers accepted the color of the product, and 90% agreed with the packaging size. About 70% of the caterers considered the product suitable for sale in the markets.

CONCLUSIONS

This is a new and challenging project in technology transfer by the Peanut CRSP to a group of farmers in the rural area of Huay-Bong-Nua village, Proa district, Cheingmai province, Thailand. The project ran as a model to measure the socioeconomic impact of such technology on a group of farmers who grow peanut as their second crop on their own lands and sell to markets in nearby districts. It is challenging to change the direction from selling raw and dried peanuts in the shell to selling a processed peanut product.

Using a marketing survey, we selected oil roasted and ground roasted peanut products. We trained a group of seven women farmers in the processing and marketing techniques, as well as in general business management. Products were placed in district and provincial markets.

Quality, shelf-life, and consumer acceptance of the products were all evaluated. Quality was good: the products were cleaner, safer, and more hygenic than products already in the market. This proved that the women were well trained and could understand the techniques in processing oil roasted and ground roasted peanut. Products became rancid after 6 weeks in the oil roasted and after 4 weeks in the ground roasted peanut; this short shelf life was due to unsuitable packaging and high temperatures in the markets. Consumers considered the products good in quality and accepted them; the ground roasted peanut had higher quality than the already existing products on the market.

We recommended that the women continue processing ground roasted peanut. Although its profitability was less than that of oil roasted peanut, ground roasted peanut had constant demand, a fast turnover rate, and better quality than the existing products. Moreover, up to 100 kg/day can be processed, compared to 30 kg/day for oil roasted peanut. This makes it, in the long run, a more suitable technology in Huay-Bong-Nua village.

The 6 months of the project is not enough time for definitive change to occur, so the socioeconomic impact of this project on the households in the village has not yet been determined. But it looks promising. The women learned techniques for processing peanut along with techniques for business and marketing management. This activity will help them improve their quality of living. For the next 6 months after the end of this project, the women earned a continuous profit of at least 1088 Bahts/month per group by working 2 days a week and selling ground roasted peanut at the Proa district market.

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