AUTHOR'S ADDRESS

Dr. Chamnan Chutkaew
Department of Agronomy
Faculty of Agriculture
Kasetsart University
50 Thanon Phahon Yothin
Bang Khen, Bangkok 10900

Dr. R.S. Paroda
Executive Secretary
Asia-Pacific Association of Agricultural
Research Institutions (APAARI)
FAO Regional Office
Phra Atit Road, Bangkok 10200

FOR COPIES WRITE TO:

The Executive Secretary
Asia-Pacific Association of Agricultural Research Institutions
(APAARI)
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BABY CORN PRODUCTION IN THAILAND

- A SUCCESS STORY

BY

CHAMNAN CHUTKAEW

R.S. PARODA

ASIA-PACIFIC ASSOCIATION OF AGRICULTURAL RESEARCH INSTITUTIONS
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- A Success Story

I. Introduction

For sustainable agriculture, it has become desirable to diversify crop production in many developing countries. Corn, because of its wide adaptability, high yielding ability and fast growing habit, has become a potential alternative. In the Asia-Pacific region, Thailand has already had considerable success with corn as an alternate crop to rice. In addition, Thailand has also successfully demonstrated that the young cobs could be used as a vegetable and could also be exported to earn foreign exchange. This story, therefore, focuses on the success of baby corn production in Thailand, and the relevance of this technology for other developing countries in the region.

Baby Corn

II. Role in National Economy

Thai government policies in the 1970s fueled the rapid growth of the economy (including the canning industry). Baby corn was selected for development because of its potential as a value added product for export and a good food substitute. Researchers developed the technology that facilitated the production and processing of baby corn to meet the high quality standards of the canneries. A public awareness campaign, initiated by the government facilitated the growth of the domestic market. The steady growth of the foreign markets has also been a pleasant surprise.

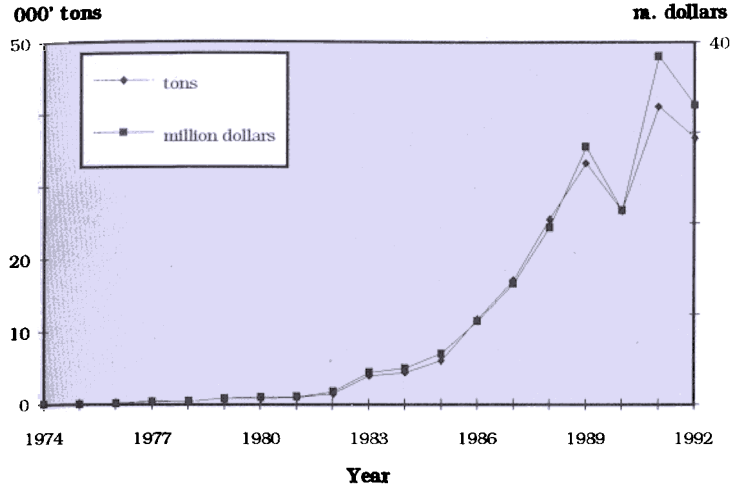
Today, Thailand has become one of the world leaders in the export of both canned and fresh baby corn. Baby corn production, for both domestic and foreign consumption, is a significant contributor to the Thai economy and has proven to be a boon to both the farmers and the nation.

In 1974, Thailand exported only about 67 tons of canned baby corn, worth US $38,095. By 1992, the volume and value had climbed to 36,761 tons, worth US $33 million (Fig. 1). Fresh baby corn also plays an important role in the export. The average quantity exported during 1988 to 1992 was around 1800 metric tons, fetching a foreign exchange of US $1.6 million (Fig. 2).

In the Asia-Pacific Region, the other maize producing countries could learn from the Thai experience and promote baby corn production to improve their economy. Accordingly, details of baby corn technology in Thailand are discussed here in brief.

III. Baby Corn Production in Thailand

Baby corn is the ear of the corn (*Zea mays L.*) plant harvested young especially when the silks have either not emerged or just emerged (1-3 cm), and no fertilization has taken place. The dehusked young ear is eaten as a vegetable. Its delicate sweet flavour and crispiness have gained it increasing popularity both in Thailand and abroad.

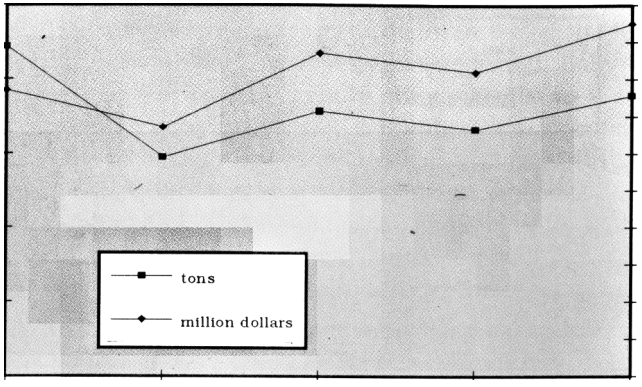


Source: Department of Export Promotion, Ministry of Commerce, 993

Fig. 1: Quantity and Value of Thai Canned Baby Corn Exports, 1974-1992

Baby corn is presently produced in all regions of Thailand. Data presented in Table 1 on harvested area, Table 2 on production and Table 3 on yield per hectare are quite encouraging. These figures show a general increase in area harvested (around 21,000 ha) as well as production (130,000 t). The western, northeastern and northern regions have emerged as major producers of baby corn. There is, however, no increase in the productivity, due to the failure of producers to use appropriate technology. This leaves room for further increases in production by targeting higher productivity through appropriate research and extension programmes.

The low price of rice is a persistent problem for Thai farmers and the government. Baby corn has proven to be a good alternative to rice, because with some amount of irrigation it can be grown four times a year. In 1989, the Office of Agricultural Economics of the Thai Ministry of Agriculture and Cooperatives compared



Department of Business Economics, Ministry of Commerce, 1993

Fig. 2: Quantity and Value of Thai Fresh Baby Corn Exports, 1988-1992

Table 1: Harvested Area of Baby Corn (ha)

REGION	1987-88	1988-89	1989-90	1990-91
Northern	2,443.0	3,681.0	5,335.0	4,435.5
Northeastern	2,147.0	2,525.0	6,077.6	2,167.0
Central	64.6	132.0	373.0	222.2
Eastern	51.0	164.2	313.6	238.4
Western	4,615.5	6,495.0	12,005.6	13,361.0
Southern	18.9	7.8	0.0	625.6
TOTAL	9,340.0	13,005.3	24,104.8	21,049.7

Source: Department of Agricultural Extension, 1991

Table 2: Baby Corn Production (tons)

REGION	1987-88	1988-89	1989-90	1990-91
Northern	13,202	20,851	33,378	25,613
Northeastern	22,339	20,832	49,678	17,315
Central	441	938	2917	1433
Eastern	284	1011	1879	1520
Western	27,821	40,640	75,649	80,277
Southern	110	38	0	3,489
TOTAL	64,197	84,309	163,501	129,647

Source: Department of Agricultural Extension, 1991

Table 3: Baby Corn Productivity (kg/ha)

REGION	1987-88	1988-89	1989-90	1990-91
Northern	5,406.2	5,662.5	6,256.2	5,775.0
Northeastern	10,406.2	8,250.0	8,175.0	7,987.5
Central	6,825.0	7,106.2	7,819.0	6,444.0
Eastern	5,568.7	6,156.2	5,994.0	6,375.0
Western	6,025.0	6,256.2	6,300.0	6,006.2
Southern	5,818.9	4,856.2	0.0	5,575.0
MEAN	6,675.0	6,381.2	6,908.8	6,360.4

Source: Department of Agricultural Extension, 1991

the costs of production and returns for baby corn and rice. The researchers concluded that growing of baby corn gave more profit than rice to the extent of US $273/ha/season.

Baby corn is quite nutritious to eat. The nutritional value of

it is given in Table 4, which is comparable to cauliflower, cabbage, tomato, eggplant and cucumber, according to Yodpet (1979). There is also no need to apply pesticides (as with other vegetables) because the young cob is wrapped up tightly in its husk. Another benefit to baby corn production has been demonstrated at some dairy farms in Thailand. By-products such as tassel, young husk, silk and green stalk are good cattle feed (especially for dairy cows). Cattle manure could thus be used to maintain soil fertility, enabling organic recycling through plant-animal chain (Chunjala, 1991).

IV. Development of the Baby Corn Industry

Due to the rapid growth of both the Thai food processing industry and the domestic markets, the commercial baby corn industry over the years also grew fast owing to the development of the following infra-structure:

i) Baby corn farmers,
ii) Regional brokers (who buy from farmers),
iii) Canneries,
iv) Wholesale merchants in Bangkok (for the local market),
v) Retail merchants in Bangkok, and
vi) Exporters.

Brokers are considered to be very important to the industry. They are the source of 95% of the supply to the canning plants in the Central region, 90% in the North and 82% in the West.

The baby corn industry is driven by both quality and quantity. For fresh markets as well as canneries, the price a producer will receive and the quantity sold would depend on:

i) Quality (yellow colour, good row arrangement, size within factory specifications),
ii) Ear size (length generally between 4-9 cm and diameter between 1.0-1.5 cm), and
iii) Season harvested.

Table 4: Nutritional Value of Baby Corn from Analysis of 100 grams Compared to Other Vegetables

Components	Baby Corn	Cauliflower	Cabbage	Tomato	Eggplant	Cucumber
Moisture (%)	89.10	90.30	92.10	94.10	92.50	96.40
Fat (g)	0.20	0.04	0.20	0.20	0.20	0.20
Protein (g)	1.90	2.40	1.70	1.00	1.00	0.60
Carbohydrate (mg)	8.20	6.10	5.30	4.10	5.70	2.40
Ash (g)	0.06	0.80	0.70	1.6	0.60	0.40
Calcium (mg)	28.00	34.00	64.00	18.00	30.00	19.00
Phosphorus (mg)	86.00	50.00	26.00	18.00	27.00	12.00
Iron (mg)	0.10	1.00	0.70	0.80	0.60	0.10
Vitamin (iu)	64.00	95.00	75.00	735.00	130.00	0.00
Thiamine (mg)	0.05	0.06	0.05	0.06	0.10	0.02
Riboflavin (mg)	0.08	0.80	0.05	0.04	0.05	0.02
Ascorbic acid (mg)	11.00	10.00	62.00	29.00	5.00	10.00
Niacin (mg)	0.03	0.70	0.30	0.60	0.60	0.10

Source: Yodpet, 1979

As the industry grew, baby corn researchers were confronted with the challenge of developing technologies that would facilitate production all the year round, with quality to meet factory specifications and quantities to meet the demands of expanding foreign and local markets.

V. Baby Corn Production Technology:

a) The Early Days

In the past, farmers had to use sweet corn and local varieties to produce baby corn because there were no suitable varieties bred for the purpose. These varieties were low yielding and susceptible to downy mildew. Later, the field corn varieties replaced sweet corn in most areas due to their higher yield and resistance to downy mildew (*Peronosclerospora sorghi*). However, because the field varieties develop quickly, they had to be harvested at the appropriate time.

The Thai government, realizing the importance of finding a variety of baby corn suited to industry requirements, initiated a baby corn breeding program in 1976. The objective was to evolve a composite variety, with high yield, yellow colour, good row arrangement, resistance to downy mildew and wide adaptation. Germplasm from various sources (including India and the Philippines) was introduced for the project. One hundred and forty seven varieties were derived, tested and selected at experiment stations and in farmers fields in all regions of Thailand between 1977 and 1981. From this research, one composite variety named Rangsit 1 was developed that had met these objectives.Rangsit 1, thus became a leading baby corn variety in Thailand before the advent of the hybrid era.

Before 1981, no baby corn seed was produced by the private seed companies. Since 1982, open-pollinated seed has been made available all over Thailand, with varieties adapted to local conditions. The Thai government has supported the private compa-

nies by making open-pollinated baby corn seed available for multiplication and marketing at low cost. The private sector has also complimented the Thai government efforts as the leading suppliers of open-pollinated and the hybrid seed.

RANGSIT 1: a Popular Open-Pollinated Variety

b) The Present Technology

Researchers recommended developing hybrid corn to replace open-pollinated varieties. Hybrid corn was preferred because it produces better quality ears and more uniform size. Since research related to the improvement of yield and quality of baby corn was very limited in Thailand, the strategy utilized for improvement was the exploitation of diverse germplasm sources, introduced from all over Thailand as well as India and the Philippines to make baby corn hybrids.

In 1988, breeders identified KBTX 3501 as a very promising hybrid. Among the newly developed hybrids, it produced the highest husk yield, an attractive standard size ear yield and low

incidence of downy mildew (Table 5). This hybrid was tested with other promising hybrids from the public and private sectors in five provinces at various planting dates. KBTX 3501 had the highest yield at each location and at every planting date. KBTX 3501 is presently one of the promising hybrids of Kasetsart University recommended for the production throughout the baby corn growing areas in Thailand.

As of 1993, the private seed companies were also selling baby corn hybrids adapted to varying growing regions. The government continued its policy of supporting the private seed companies by transferring breeding technology at low cost.

At the same time, baby corn varieties and hybrids were developed and the research was being performed to generate practices to maximize production. Baby corn production generally follows practices recommended for "normal" corn production: soil preparation, planting and thinning, controlling weeds, fertilizer applications, irrigation, detasseling and harvesting. The main difference, of course, is the short crop cycle of baby corn.

KBTX 3501-A Promising Hybrid

Table 5: Mean Yields (kg/ha) of Various Baby Corn Hybrids in 1991

VARIETY	LOCATION					
	1	2	3	4	5	MEAN
KBTX 3501	1,068.75	1,000.62	1,020.00	1,143.75	987.50	1,044.12
SUWAN 3101	1,006.25	827.50	950.62	1,001.25	793.75	915.62
NS_1 (S) C_2 F_4	770.00	762.50	751.25	931.87	646.87	772.50
SUPER SWEET DMR	615.62	568.75	578.75	803.75	565.62	625.25
CM 90	906.25	800.62	883.12	943.75	670.62	840.62

Source: Titatarn, et al., 1992

As baby corn hybrids and open-pollinated varieties became adapted in all regions in Thailand, a need was felt to modify production technology to address local conditions. Based on research performed at the experimental stations and in the farmers' fields, the scientists were able to create a package of recommendations suited to most local conditions

A study of the costs and returns of baby corn production was conducted by the Office of Agricultural Economics in 1990 (Table 6). The data demonstrated that investing in recommended inputs and practices resulted in higher production and profits to the farmers. The government and private sector have continued to work on improving baby corn production practices. Presently, research is focusing on marginal districts that have limited or no irrigation facilities and are also drought prone.

e) Future Concerns

The Sixth National Economic and Development Plan (1986-1991) of Thailand has pointed out two major concerns about baby corn production. These are:

Table 6: Economics of Baby Corn Production 1988/89

Unit: US$/

ITEMS	IRRIGATED	NON-IRRIGATED
1. Variable Costs		
a) Labour		
- Soil Preparation	49.95	41.90
- Planting + Detasseling	18.50	22.20
- Weed Control	19.62	13.50
- Fertilizer application	13.87	5.60
- Herbicide Spraying	12.50	3.75
- Water Supply	30.62	0.0
- Harvesting	54.02	41.04
b) Materials		
- Seed	32.07	18.96
- Manure	5.77	4.31
- Chemical Fertilizer	128.32	17.53
- Herbicide	12.18	1.82
- Others	28.81	11.19
c) Others Costs		
- Upkeep of equipment	4.60	2.11
- Loan Interest and Opportunity Cost	10.05	5.14
Total Variable Cost	420.88	189.05
2. Fixed Costs		
- Farm Rental	17.25	12.25
- Farm Equipment Depreciation	10.07	3.94
Total Fixed Cost	27.32	16.19
Total Cost/ha	457.75	215.10
Yield (kg/ha)	8,100.00	3,243.75
Total Income/ha (Price/kg.=$.087)	704.70	282.21
Profit/ha	246.95	67.11

Source: Office of Agricultural Economic 1993

The volume of production and the area were not sufficient to supply the demand of the canning industry, and

ii) The quality of production did not meet the requirements of the canning industry because most of the farmers used open-pollinated varieties of baby corn, leading to wide variation in size and quality.

Steady increases in production, volume and area reduced some of the deficiencies. This occurred because more farmers perceived baby corn production as a good alternative to rice, baby corn seeds were more readily available and there was a large demand for baby corn in markets. But the quantity of baby corn produced has not increased enough to meet the demand and the issue of quality still remains.

VI. TRANSFER BAI C INC

a) The Early Days: Public Relations and Education

Almost two decades ago, the idea of producing and eating corn as a vegetable must have seemed strange for most Thais. In most developing countries, corn has an image as grain for the poor people or as an animal feed or both. In addition, baby corn production required a higher investment, in terms of inputs and labour, than Thai farmers were accustomed of putting in for corn.

A public relations campaign was launched to overcome the "bad" image of corn and introduce the concept of baby corn. The messages of the campaign were conveyed through mass media:

i) Newspaper and magazine stories,

ii) Radio/television news and talk shows, and

iii) Advertising in all forms.

For consumers, the good taste and nutritional benefits were emphasized. For farmers, the potential as a good alternative crop to rice was accentuated. The public relations campaign succeeded in communicating positive messages about baby corn. Thus,

eventually both the consumer and the farmer interests increased.

The next step was convincing the people to become interested in the baby corn industry. Mass media were utilized again, but in a supporting role. The essential idea was to motivate consumers and the farmers to: i) Examine and sample baby corn products, and ii) Perform the actual procedures in baby corn production, preparation and consumption. The consumers and farmers attended promotional events held all over Thailand (with various designations: baby corn fairs, workshops and exhibitions).

The consumers were shown the ease and economy of consuming baby corn. There were cooking demonstrations and "hands on" trainings (facilitated by government and private sector home economists). Naturally, there were plenty of baby corn products which became available in the market.

Exhibition on Baby Corn

The farmers learned that they could produce a highly profitable alternative to rice. They were taken on field visits to research and demonstration plots, and visits to "model" farmers.

This was followed by "hands on" training for each step of production i.e. from land preparation to harvest. The trainings were performed both by the government and/or private sector extension agents.

Training in Baby Corn Production

b) The Present and Future

The sustained growth of baby corn industry is confirmation of the success of both the public relations and education campaign. Domestic markets continue to expand, and the number of farmers producing baby corn is still increasing (as evidenced by the steady increase in volume of production and area in production). However, if the baby corn industry is likely to expand, the farmers must increase their productivity. The technology (hybrid seeds, fertilizer, etc.) is available. The appropriate production practices have been developed. Somehow, the government and private sector extension efforts need to be accelerated to train and convince the farmers to increase further the productivity through higher input use and proper adoption of technology. Baby corn industry researchers, extension agents and farmers must collaborate to solve this problem if the industry is going to sustain its growth in the future.

VII. Secrets of Success

The success of baby corn in Thailand has mainly depended upon the following factors (after Chutkaew 1989, 1993):

i) Thai government policies that facilitated the spectacular growth of the Thai economy (in general), and the food processing industry (in particular).

ii) Cooperation between the Thai government and baby corn industry in performing a long job of public relations to "get the word out" about baby corn.

iii) Cooperation of various international agencies, including the U.S. Agency for International Development (USAID), Rockefeller Foundation, JICA, CIMMYT and FAO, for providing breeding materials, support for research, and human resource development.

iv) Introduction of new sources of germplasm.

v) Application of appropriate germplasm and breeding methods to evolve suitable varieties and hybrids. Also development of suitable production and processing techniques.

vi) Cooperation among researchers and development officials for testing of technologies over locations, seasons and years.

VIII. Future Strategies

For the long-term development of the baby corn industry in the Asia-Pacific region, research and development must be integrated using an inter-disciplinary approach (Chutkaew, 1986; De Leon and Paroda, 1993). The cooperation of the public and private sectors is, therefore, crucial. Concerted efforts in the future would be desirable to address the following:

a) Breeding and Seed Production

Cultivars should be hybrids (preferably single cross)that give high yields of uniform, good quality ears that meet the specifications of the canning industry (Chutkaew, 1985). They should mature early and be prolific and adaptable to a wide variety of conditions. Certified seeds of these hybrids should be made available in sufficient quantities to the farmers.

b) Soil and Water Management

In order to attain high yield and good quality, attention must be given to the interplay between variety and soil fertility to secure maximum benefits. Also efficient water management practices would be desirable.

c) Plant Protection and Residual Effect of Pesticides

The resistant varieties require practically no application of pesticides, thereby eliminating the residue factor and minimizing on production cost. Hence, resistant hybrids need to be promoted in the future.

d) Mechanization

The baby corn industry requires a lot of labour for harvesting and dehusking. As labour costs are increasing, it is necessary to promote mechanisation in the future.

e) Post Harvest Management

Even though baby corn has husks to protect the young ear, its freshness can be maintained for only a limited time. Therefore, information on maintaining good baby corn quality either for export in the fresh form or for processing in canneries, should be made available to persons involved in the business. Also, research on the subject would have to be intensified.

f) Processing

The quality of the product reflects upon the reputation of both the cannery and the country of export. Thus, rigorous quality

control is needed to ensure that international standards are met. Added thrust in this field would thus be helpful in promoting further the baby corn industry in the region.

g) Extension

It takes time for the output of inter-disciplinary research and development to be transferred to the persons involved starting with the farmer who produces the raw materials to the canneries where the finished product is processed for the consumer who eventually prepares and eats the product. Nevertheless, this is essential for the success of the baby corn business. Hence, concerted efforts in this direction would be critical in the future.

h) Pricing and Marketing

The price of baby corn should be reasonable, stable, and the product should be free to flow from farm gate markets to the regional markets, central markets and the destination markets both within and outside the country. Pricing and procurement policies in countries interested to promote baby corn would eventually determine the success of new ventures such as baby corn in Thailand.

i) Developing Personnel

Corn will remain one of the most important field crops in developing countries. Young people who are involved in this business will be able to make a contribution to the improvement of society. Governments in these countries should, therefore, concentrate on the development of young farmers, researchers and extension agents, cannery managers, and others involved in the private sector to find creative ways to sustain the baby corn industry. Thus, policies for required human resource development would go a long way in proper adoption of such innovative policies.

j) Regional Cooperation

Considerable scope exists for promoting baby corn technology in the Asia-Pacific region. To achieve this objective, regional

cooperation for activities such as exchange of information and germplasm, regional testing of selected hybrids and varieties, joint meetings and visits, human resource development, collaborative efforts for research and development (involving both public and private sector) and sensitization of policy makers for appropriate interventions arriving at suitable adoption of baby corn production and processing technology would be highly desirable.

IX. Epilogue

Baby corn in Thailand has become a success story which other nations in the region can emulate. The baby corn industry not only provides opportunities for higher income and potential for exports but it also generates employment for the rural poor. Besides, its use as a vegetable provides an additional source of nutrition to the consumers. In order to harness these benefits, research and development support is required, in addition to appropriate policies at the national level. Hence, considerable benefits could be derived from the Thai experience of baby corn production and utilization in the Asia-Pacific region.

Selected References

Chunjala, P. 1991. A study on an integration of beef cattle raising and baby corn production. M.S. thesis, Kasetsart University, Bangkok, Thailand. (in Thai with abstract in English).

Chutkaew, C. 1986. The future of baby corn. Proceedings of the 6th National Vegetable Workshop. Nakhon Sri Thammarat, Thailand, pp. 11-20.

Chutkaew, C. 1986. Progress of Baby Corn Industry in Thailand. Paper presented in the FAO Expert Consultation on Improved Production of Tropical Vegetables. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand.

Chutkaew, C. 1989. Successful utilization of germplasm for maize improvement in Thailand. Proceedings of the 6th International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABROA), Bangkok, Thailand pp. 645-64.

Chutkaew, C. 1993. Maize research and development in Thailand. Proceedings of the First South-East Asian Maize Workshop, Asian Institute of Technology (AIT), Pathum Thani, Thailand. pp. 122-143.

De Leon, C. and R.S. Paroda. 1993. Strategies for increasing maize production in the Asia-Pacific region. FAO-RAPA Publication 1993/25.

Panichkul, M. 1988. Soil and fertilizer application for baby corn. The Corn Industry Annual Report. National Research Council and Kasetsart University, Bangkok, Thailand pp. 65-76.

Titatarn, S. V. Titatarn, D. Anchaleesangkas, S. Sompong, M. Muangnoi, V. Sritaves & A. Bangrungkit. 1992. Screening for baby corn varieties resistant to downy mildew in baby corn production areas in Thailand. Proceedings of the 11th National Vegetable Workshop. Bangkok, Thailand pp. 1-7.

Yodpet, C. 1979. Studies on sweet corn as potential young cob corn (*Zea mays* L). Ph. D. Thesis, University of the Philippines, Philippines.