Typology of Asparagus Producers for a Comprehensive Approach to Differentiation of Cultivation Practices in Central Thailand

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Abstract

The process of diversification, including adaptation by farmers to management of new crops, was studied by monitoring the introduction of green asparagus production in a district located in Nakhon Pathom province, Thailand. A farm survey was carried out in 1990, just one year after the organization of an asparagus producers' group. Its aim was to study differences in cultivation practices, preliminary agronomic and economic results, and farmers' needs for technical references related to each type of agricultural production system (APS). Three main types of APS were identified according to their constraints and potential for green asparagus production. A wide range of technical itineraries and their variations were observed, depending on individual crop management strategies. These differences underline the unsuitability of any normative, standard "package" advice and the importance of a well-targeted technical message. A systems approach is a key tool for identifying research topics that are relevant to farmers' circumstances and needs, specially in a context of rapid transformation of the cropping systems.

Key words

Asparagus, cropping systems, cultivation practices, typology, Thailand.

Résumé

Typologie des producteurs d'asperge pour comprendre la différentiation des pratiques culturales en Thaïlande centrale

Le processus de diversification, y compris l'adaptation technique des agriculteurs à de nouvelles productions, a été étudié grâce au suivi de l'introduction de l'asperge verte dans un district de la province de Nakhon Pathom, au centre de la Thaïlande. Une enquête a été conduite en 1990, un an seulement après la formation d'un groupement de producteurs d'asperge. Son objectif était d'évaluer le niveau de différentiation des pratiques culturales, les premiers résultats agronomiques et économiques et les besoins des paysans en références techniques, en relation avec le fontionnement de chaque système de production agricole (SPA). Trois principaux types de SPA ont été identifiés, qui diffèrent par les avantages et les contraintes qu'ils présentent pour la production d'asperge verte. La large gamme de variation caractérisant les itinéraires techniques observés est interprétée comme une conséquence des stratégies mises en œuvre par les agriculteurs pour la conduite des aspergeraies. La multiplicité des pratiques culturales impose donc un message technique adapté aux caractéristiques de chaque type de SPA. De plus, l'approche système est un outil indispensable pour l'élaboration de thèmes de recherche et la mise au point de références techniques adaptées aux conditions de production et aux besoins des differents types d'exploitations, tout particulièrement dans un contexte de transformation rapide des systèmes de culture.

Introduction

As the comparative advantages of Thai agriculture are steadily declining owing to rising production costs in a context of rapid industrialization, crop diversification is one of the main issues faced by farmers and government agencies. This need for change is particularly relevant to the central irrigated plain of Thailand where small farmers tend to intensify their production systems. Most of those who have not chosen the off-farm wage-earning alternatives are now looking for labor-intensive crops that can occupy the entire family-based laborforce and provide an acceptable income for the household. Although rice and sugarcane are still widely grown, they provide only a modest proportion of small farmers' agricultural income compared with fruit and vegetables.

Asparagus was introduced in cropping systems of Thailand's central region in 1986 by Kasetsart University after several years of on-station trials. As marketing companies have contracts with farmers' organizations,

green asparagus benefits from a multiannual price guaranty system that makes it more attractive than other traditional vegetables such as onion, coriander, Chinese cabbage, and chili. Green asparagus also has the advantage of improving the regularity of labor requirements in an area faced with scarcity of temporary hired labor during peak periods. In such conditions, green asparagus production expanded rapidly between 1989 and 1991 (Figure 1).

Wide diversity was observed in the asparagus-based agricultural production systems, which range from very small familyholdings to large landowners using mainly wage-earning labor. The resulting high heterogeneity among

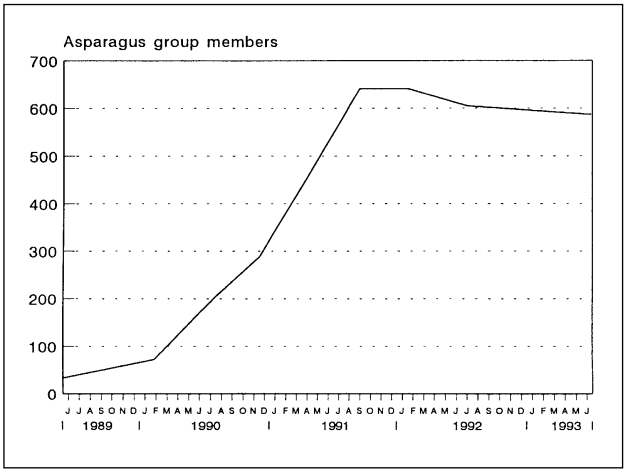

Figure 1. *Evolution of the number of green asparagus growers; Thung Kwang producer group (1989-1993).*

asparagus growers reveals wide differences in cultivation practices and final output, although all farmers were advised in the same way by extension services. Their decision making process depends on specific objectives, constraints, and potential of the selected agricultural production system (APS).

Consequently, any technical assessment or advice should not only consider agronomic feasibility but must also include an understanding of the APS. Preliminary on-farm research reveals as many situations as the different APS. To overcome this problem, a limited number of key APS with similar patterns and objectives were identified, so that technical advice could be appropriately targeted at a regional level (Capillon 1986).

Material and Methods

A farm survey was carried out in 1990, just one year after the organization of an asparagus producers' group. Its aim was to study differences in cultivation practices, preliminary agronomic and economic results, and farmers' needs for technical references related to each type of APS.

Sampling

The sample of surveyed APS was determined from a previous global APS typology study that was carried out in the same area (Naritoom et al 1990). The earlier study aimed at a general understanding of the APS: natural and technical environment, production means, history, and objectives. It was conducted at the same time as the introduction of green asparagus in the local cropping system and thus provided information about the transformation linked to the adoption of the new crop. This information on the main characteristics of APS was useful for a more detailed analysis of asparagus-based cropping systems. The initial sample of the 1990 farm survey was selected from farms studied in 1989 that adopted asparagus.

The second criterion for the sample aimed at maximum diversity of the asparagus-based cropping systems. Priority was given to the analysis of a wide range of cultivation practices rather than a representative sample of regional situations. This approach allowed an understanding of the differences between technical itineraries, in relation to the specific constraints and potential of each type of APS. It also enable the identification of a hierarchy of limiting factors, which could be alleviated through research. In the next stage the preliminary sample was examined to verify the extent to which it was representative of the regional diversity of agrarian systems. The second sampling reduced the sample size to 10 APS.

Data Collection Method

A semistructured guideline, based on open questions, was designed and tested to adapt it to the specific features of the local cropping system. Each green asparagus plot was surveyed for a 1-year period following transplantation. Data were collected on:

- plot characteristics and environmental conditions;
- laborforce availability and work schedule for different farm activities;
- equipment (purchase price and date, nature of use);
- transformation of the cropping system due to introduction of asparagus;
- farmers' short- and long-term objectives.

The following data were recorded for each plot and operation: operation date or frequency, labor requirement, working time, equipment, environmental conditions during the operation, reasons of the practice, and expected results. Data gathering was not limited to recording of farmers' remarks, even if this is often the only way to obtain information in a survey. Yield variability was analyzed to identify and rank the limiting factors, and to link them to farmers' cultivation practices.

Results and Discussion

The typology was based on the agrotechnical and socio-economic factors that characterize each type of APS.

Environmental Conditions

Agroecological potential for green asparagus production

The main features of the natural environment are described in Srijantr et al (1990). Two main land types were identified in the area, based on topography and soil charac-

teristics (Table 1). Cropping patterns and technical itineraries in these APS were related to land characteristics.

Table 1. Main soil characteristics in the Kamphaengsaen district, Nakhon Pathom province, Thailand.

	Upland	Lowland
Soil characteristics	Loam to silty clay loam texture Well drained	Silty clay loam to clayey texture Somewhat poorly drained
Land use	Sugarcane plantations; vegetable, fruit, or field crops, settlement site	Pregerminated broadcast or transplanted (less frequent) rice
Agronomic constraints	Soil prone to crusting (high silt content)	Poor drainage
Problems	Saline and sodic soils in transitional area	

Introduction of asparagus involved selection of suitable land or land development work before seedling transplantation.

– On upland loamy soils of the irrigated low terraces (90% of area planted to asparagus), environmental conditions were usually homogeneous for the different APS and offered good potential for green asparagus.
– On lower paddy soils, two main practices were observed:
  – the first practice involved the same management as on upland loamy soil (plantation on ridges after leveling). But daily yields in this case were so low (12 kg/ha) that farmers stopped production in these plots. Adverse soil-water relations due to a high water table were the main limiting factor.
  – Chinese ridges, wide rows separated by small permanently flooded drains, were used for irrigation (sprinkling boat) and drainage. They lower the depth of water table and improve drainage of the upper horizons. However, yields were still lower than on loamy soil. But Chinese ridges offer the only way to produce asparagus on heavy clayey soil in the region. The earlier practice had completely disappeared within a year.
– Another solution was to add about 30 cm of loamy soil to raise land level and improve soil characteristics. This artificial transformation of the land creates environmental conditions similar to those of upland plots which are more suitable for green asparagus production. Such an investment is justified by the high economic value of the crop and reasonable cost of transporting locally available top soil.

Land characteristics were an important factor because they determine the type of land development required before cultivation of asparagus, or they may represent a real obstacle for adoption of the crop.

The two main cropping seasons are determined by temperature and rainfall changes during the year: a dry, cool season from November to February (average monthly temperature or AMT = 25°C) and a hot season from March to October (AMT = 30°C). In these conditions, green asparagus benefits from year-round production. The first harvest takes place as early as 5–6 months after transplanting 4- to 6-month seedlings. The best quality is obtained during the cool season. Rapid growth rates increase the percentage of outspect yield when temperature rises.

Heavy monsoon rainfall from May to October is the main form of precipitation. Average annual rainfall in the study area is 1100 mm (Figure 2a). Irrigation water (canal and artesian wells) compensates for the rainfall deficit between November and April. In such a biophysical environment, spear harvest can be staggered over 8 months in a year.

Socioeconomic potential for asparagus production in the study area

Regional economic development characterized by a good road network for easy access to Bangkok and its airport and port is an important local comparative advantage for exporting vegetables such as green asparagus. The rapid development of agroindustries in the western part of the

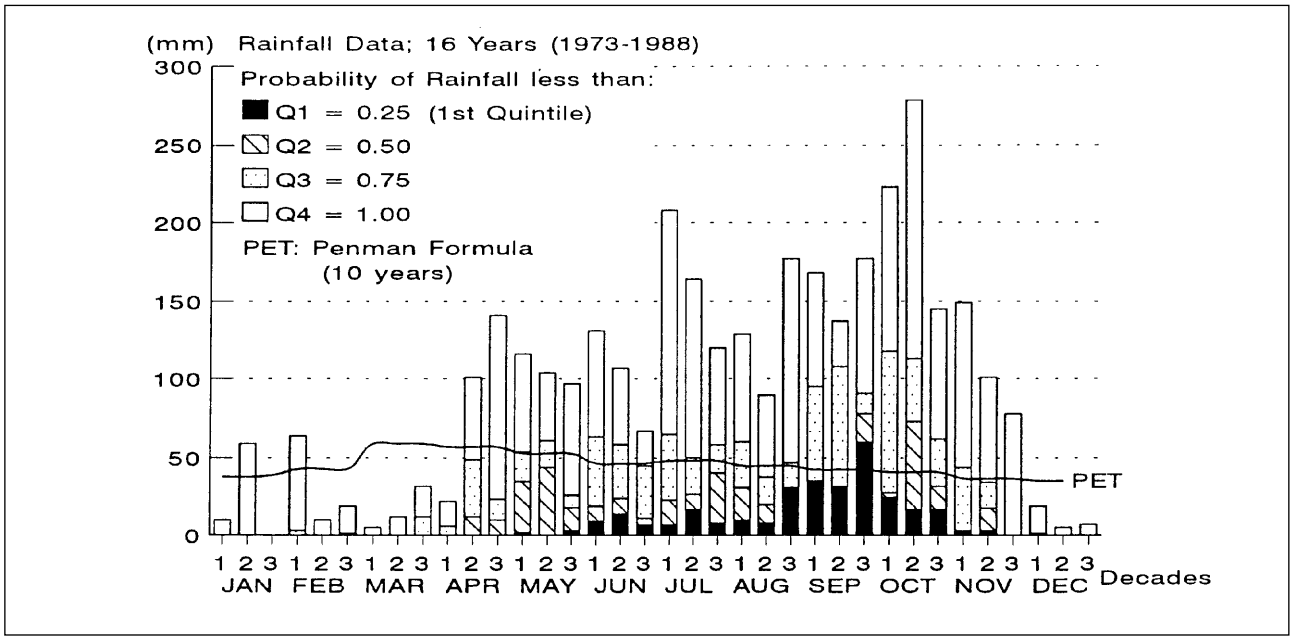

Figure 2a. *Frequential climatic Analysis; Kamphaengsean District, Nakhon Pathom Province.*

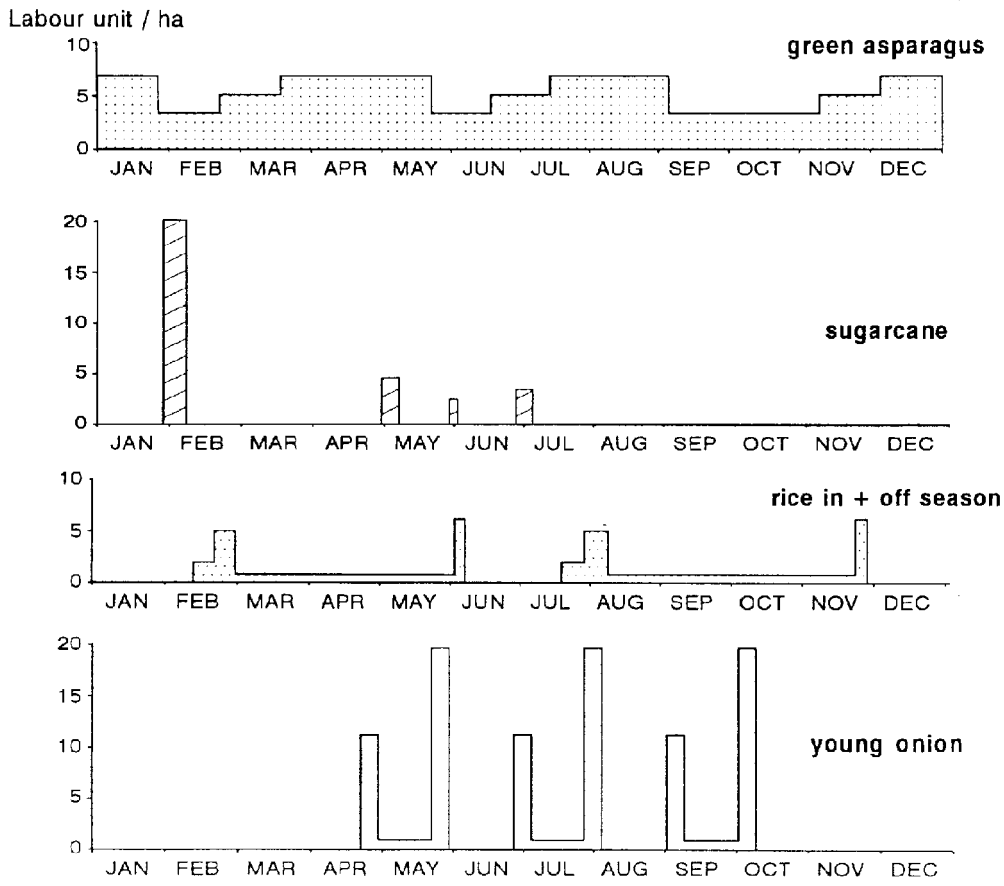

Figure 2b. *Cropping calendar of the main productions in Kamphaengsaen district.*

central plain has integrated local farmers in new commercial systems as they shift from traditional vegetables, sugarcane, and livestock to export crops and integrated farming systems with swine or poultry. They benefit from efficient networks for distribution of farm inputs and marketing of their products.

In the study area is a category of experienced, traditional vegetable growers—mostly of Chinese origin—who can afford to take risks such as growing a new crop. Most of the green asparagus producer group committee members have a strong bargaining power vis-à-vis the marketing companies. The support of this efficient farmer organization has largely contributed to the successful spread of asparagus production in the area (Naritoom et al 1991).

Consequences of the Introduction of Asparagus in the Local Agrarian System

Improved economic results

The farm survey conducted among 10 APS showed satisfactory economic results in 9 out of 10 cases of asparagus production (Table 2). In several situations, labor productivity (annual value added/worker) and family income (value added–hired labor cost–interests–taxes–other social costs) reached high levels. The only failure recorded was due to inappropriate choice of land and poor maintenance of the crop during the first year.

The best economic results (farm B) were obtained with limited fixed costs—without investment in expensive equipment and a reasonable level of inputs (US$2500 –3800/ha) during the first year. Seedlings and fertilizers each represented only one-third of total cost.

An important reason for the success of green asparagus in the Kamphaengsaen area was that its adoption allowed local small farmers to achieve their own economic objectives. They could aim for maximum annual value-added per land unit (up to US$15 000/ha) or per family labor unit (up to US$16 000/worker) on very small or small (<1 ha/family labor unit) farms, respectively. Compared with other local crops (Figure 3), asparagus generated high value-added/worker (20 times more than sugarcane using current management practices) and guaranteed economic sustainability of the small APS, despite reimbursement of past debts (Trébuil, Dufumier 1990).

Improved labor management

The successful introduction of green asparagus introduction was also due to improved labor management. Cropping schedules for traditional vegetables (eg, Chinese cabbage, young onion, coriander, yam, beans), have a

Table 2. General characteristics of 10 (A—J) contrasted APS and economic results for the first year of green asparagus production (in US$/ha), Thailand.

Parameter	A	B	C	D	E	F	G	H	I	J
Farmed area (ha)	1.8	0.5	11.2	1.2	1.8	1.1	5.0	7.0	12.3	14.9
Crop (ha)										
Sugarcane	1.0	-	0.4	-	0.5	-	3.5	4.2	9.6	12.5
Rice	0.3	-	2.3	0.8	-	-	-	1.6	-	-
Vegetables	-	-	0.2	-	-	-	0.2	-	-	-
Asparagus	0.2	0.4	0.4	0.4	1.0	1.1	1.3	1.3	1.8	2.4
Others	-	-	8.5 cassava	-	-	-	-	-	0.3 mango	-
Animals (heads)	2 geese 6 pigs	-	-	-	-	-		10 cows	100 pigs	-
Laborforce										
Family	1.5	2.0	6.0	2.0	6.0	2.0	9.0	6.0	7.0	6.0
Hired	-	-	-	-	-	2.0	-	2.0	4.0	8.0
Asparagus area/ worker (ha)	0.1	0.2	0.1	0.2	0.2	1.2	0.2	0.2	0.2	0.2
Economic data (US$)										
Gross product	500	18 625	12 250	11 950	11 125	13 375	14 150	9 350	14 175	15 875
Input	940	2 825	3 300	2 440	3 710	3 900	3 35	2 720	3 025	
Gross margin	(440)	15 800	8 950	8 225	8 685	9 665	10 250	6 115	11 455	12 850
Fixed costs	0	330	210	80	220	190	400	475	135	560
Value-added	(440)	15 470	8 740	8 145	8 465	9 475	9 850	5 640	11 320	12 290
Labor productivity	(220)	16 580	6 245	10 180	8 465	10 360	9 610	6 180	12 980	15 970
Family income	(440)	15 350	8 110	7 795	8 325	8 660	9 490	3 765	10 275	11 130

comparatively irregular demand for labor, particularly at harvest (Figure 2b). The growing scarcity (and higher cost) of temporary hired labor in the villages made farmers rapidly adopt green asparagus because of its more regular labor requirements.

Labor was the main constraint to the expansion of the asparagus-growing areas. On 8 surveyed farms with established asparagus production, all available family workers were employed for the crop. The maximum area per worker was approximately 0.25 ha but it was reduced to 0.15 ha/worker at harvest. Seven of the 10 surveyed farms relied on hired labor. Such cropping systems are highly labor intensive because of low mechanization of cultivation practices (transplantation and spear harvest are fundamentally manual operations). Green asparagus production protects the competitiveness of small farmers as there are no foreseeable economies of scale.

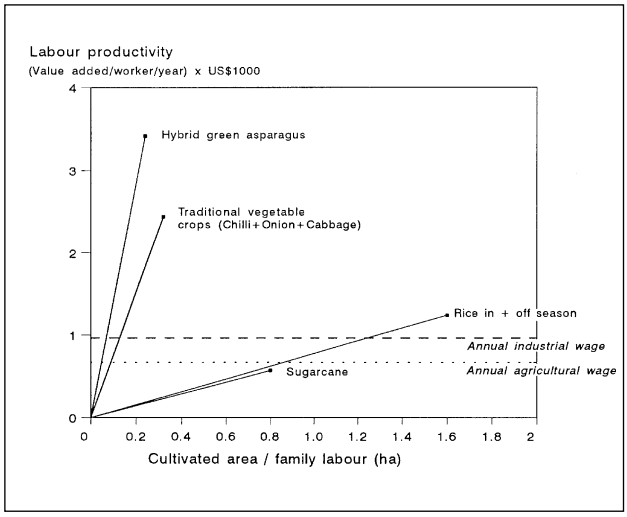

Figure 3. Compared labour productivities of the main cropping systems in the kamphaengsaen region, Central Thailand.

Competition for land with the dominant sugarcane enterprise is low. In 1990 asparagus plantations in the Thung Kwang area of the Kamphaengsaen district occupied 4—100% (0.2—2.5 ha) of the cropped area on the surveyed farms, whose size varied from 0.5 ha to 15 ha (Table 2). However, adoption of green asparagus by small farms has not significantly reduced sugarcane acreage because of the high labor requirement of asparagus crops. As 1 farm worker is needed for 0.25 ha of asparagus, the remaining cropped area must be planted to an extensive crop like sugarcane to avoid peaks of labor demand.

As asparagus is the main source of agricultural income (providing 60—100% of total value-added of a farm), it has a higher priority than other crops for technical options, investments, and operations schedule. Temporary workers are hired through middlemen to overcome labor peaks for other crops (eg, sugarcane harvest) (Trébuil et al 1993).

The development of technical itineraries depends on the particular role of asparagus for each farm; an APS typology was established to facilitate this exercise.

Typology of Green Asparagus Producers

Several quantitative criteria were used to establish a limited number of APS types based on the main strategies, potential, and constraints for green asparagus production. Data on labor requirements for green asparagus (1 labor

Table 3. Typology of three asparagus-based agricultural production systems (APS) in Tambon Thung Kwang, Kamphaengsaen district, Thailand.

Parameter	APS I	APS II	APS III
Land			
Asparagus area (ha)	0.2—0.8	0.8—1.5	1.5—2.5
% asparagus area of total cropped area	4—10; 90—100	25—100	<15
	crop diversification or early stages	no further increase of asparagus area possible	difficult to increase area: – no land available – distance from the house
Laborforce characteristics			
Asparagus area/family worker (ha)	0.1—0.2	0.2—0.5	0.25—0.5
Total number of workers	2—5	6—9	>9
Constraints	Saturation of family laborforce Cannot hire labor		difficult to find hired labor at harvest
Capital (US$/ha)			
First year investment	1200	2000	1700
Intercrop	+	+	–
Reasons for intercropping	Cash income before green asparagus harvest (1 year after sowing)		No problem with cash flow
Techniques			
% seed price in total seedling cost	<60%		70—80%
	Lower seed quality chosen to reduce input costs		Priority to high genetic potential: hybrid seed
Frequency of sprinkler irrigation	25%	75%	0%
	Save family laborforce, low level of adoption because of high price		Disease risk

unit/0.2 ha) indicated that plantation size was a key indicator of the APS type owing to the low level of mechanization. However, this criterion depends not only on labor management, but also on land suitability and capital availability; it determines the possible type of crop management. Three APS classes were identified on the basis of these criteria (Table 3).

Type I farmers have small asparagus plantations (0.2—0.8 ha). This type can be divided into two subclasses, based on the importance given to asparagus in the cropping system.

– The first class (I-A) includes the very small APS that have planted all available land to green asparagus. Their main objective is to maximize income per land unit by using only family labor. The low level of available savings and cash flow restrict initial investments for transplantation (no fixed costs for equipment, low input use). Such small farmers cannot mobilize funds to surmount the nonproductive phase of the young plantation. They may plant one or two cycles of short-term intercrops (baby corn or other vegetables) for early cash income.
– In the second class (I-B), asparagus is grown for crop diversification. One surveyed APS, which had just started growing asparagus, should, however, be classified in transition between I-B and II-B because of increasing specialization in green asparagus production.

Type I farmers try to recover their investment rapidly through an early intensive harvest, whereas types II and III can afford lower gross product during the first year to conserve the potential of the young plantation. Technical options during the first 6 months of the plantation are generally inferior to those adopted by types II and III. Cash flow availability is the main limiting factor for the choice of genetic material, land preparation techniques, and irrigation system.

The strategy of type II APS is to saturate available family labor or land suitable for asparagus located close to the house. Both options depend on the characteristics of the APS:

– When family labor is adequate (II-A), the objective is to maximize labor productivity per family worker. A better economic situation allows these farmers to afford technical options superior to type I. However, fixed costs are high because of investments in labor-saving equipment (sprinkler irrigation).
– When available family labor is low compared with cropped area (>0.2 ha/family worker), temporary or permanent workers are hired to expand the plantation area and thus maximize value-added per family worker. This type can be distinguished from the type III by the limitation on the asparagus area due to the lack of suitable land; asparagus covers all the land that is suitable for this crop.

Type III are capital-oriented farms that employ mainly wage-earning labor to extend the asparagus area over all the suitable plots located near the house. The best technical options (furrow irrigation to reduce risk of canopy diseases caused by sprinklers) can be adopted because of adequate available capital and labor. The main constraint is scarcity of hired workers, because asparagus production tends to

Table 4. Strategies of different types of asparagus in the Kamphaengsaen district, Thailand.

Asparagus area: 0.2—0.8 ha
Type I-A
— Maximize annual net income per land unit
Means of production
– Cropped area/family worker <0.8 ha
– Specialization in asparagus production: 100% of value-added generated on APS.
– Family labor only (2 labor units)
– Low cash availability
Type I-B
– Maximize agricultural income on total cropped area
– Diversify crops
– Occupy all family labor
Means of production
– Cropped area/family worker: 0.8—1.5 ha.
– Family labor only.
– Low investment level
– Other labor-extensive enterprises (cassava, sugarcane, livestock)
Asparagus area: 0.8—1.5 ha
Type II-A
– Maximize labor productivity per family worker
– Reduce labor demand peaks for family members
Means of production
– Cropped area/family worker < 0.8 ha
– Family labor only
– Specialization in intensive vegetable crops
– High fixed costs (sprinkler irrigation system, high quality seedlings)
– Intercropping for income before first spear harvest
Type II-B
– Maximize labor productivity per worker
– Maximize area planted to green asparagus
Means of production
– Cropped area/family worker: >0.8 ha
– Permanent hired workers for asparagus (25—50% of total labor)
– High fixed costs (land development works, irrigation system)
– Other labor-extensive crops (sugarcane, rice, etc) managed by temporary hired workers
Asparagus area: 1.5—2.5 ha
– Maximize profit rate
Means of production
– Cropped area/family worker: >1.5 ha
– Hired labor/total labor: >35%
– Best technical options

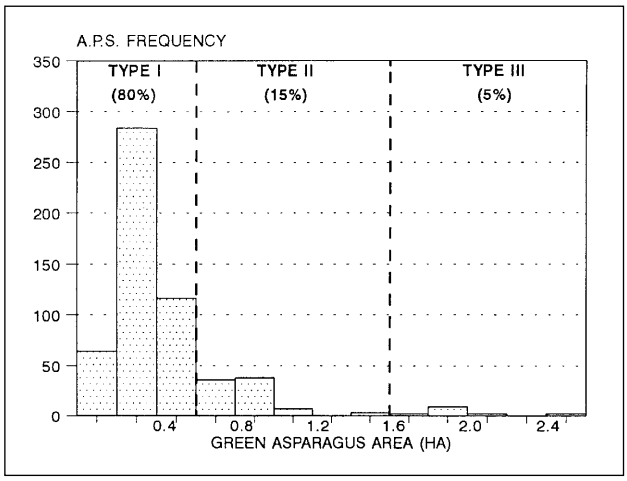

Figure 4. Distribution of the 560 members of the Thung Kwang green asparagus producer group on 1991 according to plantation acreage.

occupy most of the local available labor. Agricultural wages have increased and hired workers have started bargaining for long-term employment contracts.

Although production conditions varied within each defined type (environmental conditions, family labor availability, technical options, objectives), the main strategies can be summarized (Table 4).

Results of this typology were verified by checking whether a new sample of farms could fit into the classification. The objective was to test the extrapolation range of the typology. Once the study was completed, any given farm could be placed within a type without the lengthy process of a farm survey. By using simple criteria, such as area planted to asparagus, labor, and input management indicators, any given APS could be classified in its correct type. The share of each farm type in the whole population of asparagus growers was then assessed in the study area (Figure 4).

Conclusion

This study served to establish technical itineraries suited to each of these five APS subtypes, which presented similar advantages and constraints for green asparagus production. The design of on-farm experiments carried out since 1990 have been based on this typology so that they correspond to farmers' needs and objectives (Sayampol, Castella 1991). The effect of seedling age at transplanting, date of the first harvest, number of mother stems, and intercropping practices on asparagus yield potential were studied according to type I-A constraints. The impact of land preparation practices on soil-plant relations was assessed to answer queries by type II farmers. Varietal trials and breeding research were conducted to provide type III farmers with high-yielding cultivars.

However, several questions still remain about the future of green asparagus production in the Thung Kwang area. How long will production be sustained by the highly intensive management practices observed through the farm survey? Research and extension services are confronted with the issue of the intensive crop management capacity of farmers and consequently the ecological sustainability of their practices (Huang 1985; Waibel, Setboonsarng 1992).

Another source of uncertainty for farmers in a context of rapid socioeconomic transformation is the marketing of their produce through asparagus growers' organization (Trébuil et al 1993).

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