

17. Smallholder Cultivation of katuk (*Sauropus androgynous*) and kucai (*Allium odorum*): Challenges in Sustaining Commercial Production and Market Linkage

James M. Roshetko¹, Iwan Kurniawan and Suseno Budidarsono²

Abstract

The development of smallholder farm enterprises is usually concerned with commercialization to increase farm incomes. Once the farmers have made decisions of what commodity to produce, they must decide on how to allocate their available resources to achieve the best output. Smallholder vegetable producers face some major uncertainties which impose difficult planning horizons. In many cases, vegetables reach a stage close to harvest, but the crop does not meet market specifications, or insects and disease cause significant damage and loss of marketability. An action research study was conducted to (1) identify the key factors that motivate smallholder farmers to adopt commercial-oriented vegetable production and create and maintain market linkages of their vegetable products and (2) implement possible interventions that enable farmers to overcome marketing problems and capture market opportunities.

Data and information were collected using a Rapid Market Appraisal (RMA) methodology. Small landholdings, a shortage of household labor, and limited market information often limit the diversification and expansion of vegetable production. In managing their systems, farmers show a preference for familiar crops and technologies. Most smallholders are reluctant to adopt new innovations that have not been proven successful. Key factors that motivate smallholder farmers to adopt commercial-oriented technologies and create and maintain market linkage are: 1) a stable commodity price, 2) knowing the best management practices for commodity production, 3) intensive early facilitation to identify and develop production and market opportunities, 4) clear farmer group goals and mission, and 5) informative success stories. The following interventions proved successful in addressing farmers' marketing problems: training in group dynamics, training in pest and disease management, implementation of best practice production techniques and distribution of market information among farmers.

Keywords: Market linkage, smallholder farmer, vegetable agroforestry systems (VAFs), rapid market appraisal (RMA)

¹World Agroforestry Centre (ICRAF) Southeast Asia Regional Office, Jl CIFOR Situgede, Sindang Barang, Bogor 16165, Indonesia and Winrock International, Bogor, Indonesia. j.roshetko@cgiar.org

²World Agroforestry Centre (ICRAF) Southeast Asia Regional Office, Jl CIFOR Situgede, Sindang Barang, Bogor 16165, s.budidarsono@uu.nl

1. Introduction

Most smallholder farmers face many constraints and challenges in marketing their products. Small landholdings do not reflect economics of scale. Limited planning, low levels of inputs and management and poor post-harvest handling result in yields of low quantity and quality. Limited access to market information and strong dependence on local collectors result in unfavorable bargaining positions for smallholders. Because of suboptimal production conditions smallholder produce do not meet market specifications for quantity and quality, resulting in lower prices received by farmers (Arocena-Francisco et al., 1999; Hammet, 1994).

The development of smallholder farm enterprises usually entails commercialization to increase farm income. Most smallholder activities focus on progression towards the more efficient and productive use of limited farm resources and the creation of market linkages. This progression nearly always implies an increase in the quantity and quality of farm products. Farmers' available resources - including soil, sunlight, water, land holdings, labor, and capital - greatly influence productivity and income. Once the farmers have made decisions on what commodity to produce, they must decide how to allocate their available resources to achieve the best output (Warthon, 1969).

Smallholder vegetable producers face some major uncertainties which impose difficult planning horizons. Product prices often vary day-to-day, seasonally, and year-to-year; yields vary from season to season; planting and harvesting times may vary considerably due to inconsistent weather patterns. Price uncertainty is a result of the biological lag time between planning, production, harvest and sale. In many cases, vegetables reach a stage close to harvest, but the crop does not meet market specifications, or insects and disease cause significant damage and loss of marketability.

Market opportunity indicates what commodity farmers should produce and where to make the commodity available to the consumer. Farmers must decide to meet those market needs. What goes into marketing commodities? How are links to the market made and sustained? How do farmers get information about commodity market demand? How should they interact with the market actors and how do they sell their commodities? How should they manage their farm enterprises? The market is there to be served and exploited, but farmers need to seize those opportunities. Unfortunately, most smallholder farmers are ill-prepared for this task, and they then need assistance (Roshetko et al., 2007). By linking commodity production with market opportunity, farmers can learn what adjustments to make in the production system to better serve market demand.

The World Agroforestry Centre (ICRAF) and Winrock International conducted action research activities in Nanggung Subdistrict, Bogor District West Java to reach motivated and innovative farmers who were committed to improving their incomes by increasing the production and market access of their agroforestry products, specifically commodities produced in vegetables agroforestry systems (VAFs). Activities were conducted as part of the *Agroforestry and Sustainable Vegetable Production in Southeast Asian Watersheds* project supported by the USAID-funded SANREM-CRSP.

The objectives of the activities were to: 1) identify the key factors that motivate smallholder farmers to adopt commercial-oriented vegetable production and to create/maintain market linkages for their vegetable products; and 2) identify interventions, and implement these, to assist farmers to overcome marketing problems and capture market opportunities. This chapter reports the results on how smallholder farmers can establish commercial oriented systems and maintain market linkages.

2. Materials and Methods

2.1 Site

The research sites were located in Parakan Muncang, Hambaro and Sukaluyu villages, Nanggung Subdistrict. Nanggung is a rural area with reasonable access to the urban markets of Bogor (1-hour drive) and Jakarta (2-3 hours). The area borders Gunung Halimun National Park, a major watershed for the Jakarta vicinity and an important reservoir for biodiversity.

2.2 Household study

A household study identified how farmers' socioeconomic characteristics influence their ability to produce vegetables, the type of vegetable production systems preferred, and the economic productivity of those systems. The study was implemented in June-July 2006, with analysis during the remainder of 2006 and early 2007 (Wijaya et al., 2007).

2.3 Market research

Market information was collected using an iterative and interactive Rapid Market Appraisal (RMA) research methodology. As opposed to formal sub-sector analysis, RMAs aim to provide a quick, flexible and effective way of collecting, processing and analyzing information and data about markets and marketing systems. They are an efficient way to acquire knowledge on marketing systems, with a view to inform production and marketing strategies, policy processes, and the design and implementation of relevant interventions. The RMA activities included: market chain identification, focal group

discussion with farmers and traders, a market potential survey, and a consumer preference survey. The approach used was adapted from Young (1994), ILO (2000) and Betser (2000).

3. Results

3.1 Household study

The household study covered 185 households and showed that 52% of the Nanggung population live below the poverty line. Agriculture is the main occupation of 59.4% of the working population; an average of 5.2 hrs/day is spent on agriculture activities. Trader/merchant is the main occupation of 20.5%. Agriculture accounts for 14% of household incomes and trade is 42%. The average landholding is 0.42 ha/household. Land is unevenly distributed, with 52.4% of households with access to less than 0.2 ha. Rice fields comprise over 57% of agricultural land, upland systems 23% and tree garden systems, 20%. Only 27% of respondents have experience in producing and marketing vegetables, which are produced in upland or tree garden systems. Over 70% of rice production is for family consumption; 90-100% of vegetable production (with the exception of corn) is sold. Smaller landholdings are more intensely managed. Most labor and agricultural inputs are dedicated to rice production (Wijaya et al., 2007).

3.2. Market chain identification

A survey of 75 farmers, community leaders and traders identified four market channels used by smallholder farmers in Nanggung to sell their vegetable products:

Channel A: Farmers % Neighbors/local household

Channel B: Farmers % Local traders % Local market (Cibeber and Nanggung)

Channel C: Farmers % Local market (Cibeber and Nanggung)

Channel D: Farmers % Local market % Regional market (Luwiliang and Bogor), and national markets (Tangerang, and Jakarta).

About 71% of vegetables are sold through Channel A, 18% through Channel B, and the remainder (11%) through Channels C and D. The distance to market, quality and quantity of product, and road infrastructure are the factors that influence the selection of market channel. The main market players are farmers, local traders and merchants in local and regional markets. Farmers are primarily producers. Traders are engaged in collecting, sorting, grading, storing and transporting the products.

3.3 Focal group discussion

A focal group discussion (FGD) was conducted with 35 farmers and 5 local traders who were interested in improving their vegetable production and marketing activities. The key points discussed were (1) what factors limit the current vegetable production and marketing systems; and (2) where is there potential to expand.

Farmers' main constraints were limited landholdings and small-scale vegetable production. The quantities and quality of vegetables produced were low and irregular. Farmers had little market information and did not produce vegetables based on existing market demand. Additionally, farmers had limited access to technical assistance or credit to improve vegetable production. Farmers marketed their vegetable products as individuals and thus did not benefit from economics of scale.

Local traders' main constraints followed those of farmers. The supply of vegetables from farmers was irregular and unreliable in quantity and quality. The vegetables produced were not sorted or graded, and primarily of low to medium quality. Additionally, traders had limited knowledge and facilities for storage. These conditions made it difficult for local traders to establish permanent linkages with traders further up the market chain.

Given the existing conditions, farmers and traders suggested that the expansion of vegetable production should focus on a limited number of species that can be produced in the understory of tree gardens (the land use systems available for expanding vegetable production), that require little investment and limited maintenance. Additionally, market demand for the product should be stable and lucrative, and there should be an existing accessible market chain.

3.4 Market potential and consumer preference surveys

Following the FGD, a market potential survey (this was done with semi-structured questionnaires) identified candidate species for smallholder production. Four indigenous species were identified: 'katuk' (*Sauropus androgynous*), 'kucai' (*Allium odorum*), 'honje' (*Etlintera* sp.) and 'tebu telor' (*Saccharum officinarum*). All four species can be produced in understories, market demand is stable, and to varying degrees farmers are familiar with the species. A consumer preference survey was conducted with 150 people in project villages (90 people), a subdistrict market town (30), and in Bogor (30). Consumers were aware of all four species, with demand for katuk and kucai higher. Price and quality were the key factors that influence consumer purchase decision. While mainly satisfied with commodity quality, consumers would like to see better quality and more reliable quantities. Con-

sumers were not always able to buy sufficient supplies to satisfy their preference for the commodities (Dahlia et al., 2010). A summary of the evaluation of the four species is provided in Table 1.

Table 1. Evaluation of four indigenous vegetable species for smallholder production

Species	Use	Current Condition	Potency to Improve
Katuk, <i>Sauropus androgynous</i>	Vegetable, medicine, dye, ornamental plant	Planted in small areas as a hedge around or in gardens. Mainly produced to meet subsistence household needs. No village level production information available. Perishable, can be stored only 2 days after harvest.	High demand in local and regional markets. Shows potential as an understory component of tree garden systems. Low management and inputs requirement.
Kuca, <i>Allium odorum</i>	Vegetable, spice, medicine	Grows in the understory of tree garden systems. Farmers are familiar with the species, especially in Sukaluyu village. Market demand stable and strong market linkages exist. Attractive short term income.	Strong niche market demand. Need to improve quantity, quality and reliability of product. Suitable for sloping lands and higher elevations. Low management and inputs requirement.
Honje, <i>Etlingera</i> spp. (Ginger bud in English)	Spice, fruit, vegetable, medicine, textile dye, tanning, perfume	Grows in understories and open areas. Farmers are familiar with, grow, and use the species. Irregular and small yields. Can be stored for 7-14 days after harvest. Markets exist. Three local collectors serve the Nanggung area.	Demand in Jakarta and Tangerang is strong for reliable quantities. Demand exceeds supply. Need to improve processing, packaging, and storage of the product. Post-harvest processing enhances price margin.
Tebu Telor, <i>Saccharum officinarum</i>	Vegetable, fodder, hedge, ornamental plant	Small yields and low prices. Production uncommon and unfamiliar to farmers. Grows in the understory of tree garden systems. Can be stored for 7-14 days after harvest. Leaf by-product used as cattle fodder.	High market demand at regional market. Not yet commercialized, need to develop permanent market chain. Need to improve yield, quality, processing, packaging, and storage. Low management and inputs requirement.

Analysis of the survey data indicated that katuk and kucai held greater potential for smallholder farmers. Both species are familiar to farmers and known to be suitable for biophysical conditions in Nanggung. Products can be harvested 3 to 4 months after establishment and every 45 days thereafter until plants are 5 to 7 years old. Additionally, market prospect and price are good for both species in Jakarta and Tangerang.



Figure 1. Post-harvest handling for market of *Saccharum edule* and *S. edule* packed ready for the market



Figure 2. Post-harvest handling of bananas

4. Discussion

4.1 Vegetable agroforestry systems and market orientation

Vegetable agroforestry systems provide multiple benefits to the farmer producer - products for home consumption and market sale, income from market sales, and enhanced diets (health). Compared to annual cropping systems,



Figure 3. *Sauropus androgynous* post-harvest handling

integrated agroforestry systems reduce soil erosion, replenish soil fertility and reduce risk through diversification. In deciding which species to produce, farmers need to consider many factors: expected market price, labor and other input costs, production period, germplasm availability, management knowledge required, and opportunity costs. Faced with these decisions, it is common for farmers to follow what their neighbors are producing.

In Nanggung, vegetable production is seen as an additional income stream, even though farmers feel they have suboptimal knowledge and experience with commercial vegetable production. Cultivation is limited to small plots with little agricultural inputs. Although 90% to 100% of the production is sold, the quantity, quality and reliability of vegetable production are all low. About 89% of the vegetables marketed are sold to neighbors, other households, and local markets where product specifications do not exist. Low quantities and medium quality are acceptable. The volume purchased per customer is small, but price per unit may be high. Customers are satisfied with the higher price in exchange for the convenience of buying at home, as well as the time and money saved by not going to the market. Similar conditions have been identified with banana commerce in Nanggung (Tukan et al., 2006).

The potential for larger incomes from vegetable production in Nanggung exists. There is high demand for vegetables in the lucrative markets of

Jakarta and Bogor and industrial demand for some vegetables. Those markets require large reliable quantities of products that meet quality specifications. Farmers need to improve their productivity to meet the demand of those markets. To achieve improved productivity, farmers need assistance in the areas of species selection, production technology, related agricultural inputs, and marketing. Local traders are interested to collaborate with farmers to overcome the constraint of small, low quality, irregular supplies of vegetable products. Collaboration helps achieve economies of scale for farmers and efficiencies of supply for traders.

Analysis of local conditions indicated that farmers and traders should focus on the production and marketing of katuk and kucai. Both species are familiar to farmers, are suited to the local biophysical conditions, and can be produced in understories. Plants remain productive for 5 to 7 years before re-establishment is required. It was acknowledged that to achieve success in commercial production and marketing of katuk and kucai, smallholder farmers would require technical and material assistance.

A cross-visit was conducted to Ciampea, a village about one hour from Nanggung, where several smallholder farmers operated market-oriented katuk and kucai production systems. In Ciampea, both kucai and katuk were first harvested 3-4 months after planting and every 45 days thereafter. Kucai production was about 600 kg/1,000 m² at a farmgate price of Rp1,700-2,000/kg. The price received in 2001 was only Rp500/kg. Since then market demand has increased and farmers have improved product quality to attain higher prices. Katuk production was noted at 500 kg/1,000 m² at a farmgate of Rp2,200/kg. Farmers preferred to sell their crop at the farmgate, as harvest and transport costs were borne by the trader. Cassava was intercropped with katuk and harvested at six months yielding about 800 kg/1,000 m² at a price of Rp450/kg. The visit to Ciampea exposed participants to effective production and marketing practices and provided insights into competitive positioning, as well as the challenges and opportunities for the development of a marketing plan.

To initiate commercial production of katuk and kucai in Nanggung, farmers sought assistance from an experienced farmer in Ciampea. Guidance was provided in germplasm selection, best management practices, and harvesting. Traders committed themselves to purchasing products at the farmgate at an agreed price. The technical input and market assurance, combined with the exposure trip to Ciampea, gave farmers the confidence to launch a commercial endeavor, overcoming their inherent aversion to risk.

To further foster commercial development of katuk and kucai in Nanggung, production trials were established on a land (approximately 6,000 m²) belonging to five farmers and the district agricultural research agency. The

trials were intended to (1) determine katuk and kucai performance and yields under smallholder conditions in Nanggung, (2) enhance farmers' capacity and experience, and 3) produce commercial quantities of katuk and kucai.

Approximately 60,000 katuk stems and 7 kg of kucai seed were distributed to participating farmers and the agency. In return for the support to establish trials, the farmers and agency agreed to multiply germplasm for distribution to other local interested farmers. This approach was a means to accelerate the production of katuk and kucai in Nanggung.

Katuk and kucai are attractive products in local, regional and national markets. A big market for fresh katuk leafs exists in Jakarta and Tangerang. Daily demand for katuk from Ciampea farmers alone exceeds 15 tons. At a farmgate price of Rp 1,800/kg, daily transactions of katuk from Ciampea were Rp27,000,000/day (US\$2,935/day). The daily demand for dried katuk leafs from the pharmaceutical industry was 5 tons at Rp10,000-Rp15,000/kg. It requires approximately 4 kg of fresh leafs to make 1 kg of dried leafs. Economically, post-harvest processing of fresh leafs to dry leafs should be an attractive activity for farmers, providing them the opportunity to increase their price margin. However, the farmers sell fresh leafs because they lack experience, capital, technology and confidence to efficiently dry the leafs.



Figure 4. Pak Kastolani (center), successful Ciampea farmer, provided mentoring to Nanggung farmers regarding the best management practices for production, processing and marketing of katuk and kucai

Demand for kucai is also high, exceeding 1 ton/day in Tangerang market alone. There is daily demand for kucai in local, regional and Jakarta markets, as well as from bread factories. Those demands are difficult to quantify as market chains co-mingle and information on supply/demand is unclear. Farmer gate prices for kucai are approximately Rp2,200/kg (Rp1,800-Rp 2,300). The kucai prices quoted by traders are roughly similar to those indicated by Ciampea farmers; while the katuk prices are slightly higher compared to Ciampea. Demand for katuk and kucai exceed current supply and prices are stable throughout the year.

The trials conducted in Nanggung demonstrated that farmers can expect yields similar to those in Ciampea. Based on farmers' actual production data the following incomes are estimated for smallholder katuk and kucai production (1,000 m² of each crop). For katuk establishment and production costs are roughly Rp2,500,000 for the first 3-month period. Approximately 90% are one time expenses for germplasm, land clearing and tools. Thereafter production costs are Rp250,000 for every 45 days. Revenue per harvest (3 months after establishment and every 45 days thereafter) is approximately Rp 880,000. In the first year a smallholder farmer could earn Rp2,500,000 from 1,000 m² of katuk. For kucai the initial investment would be Rp1,600,000, with subsequent production costs of Rp770,000 every 45 days. Revenue per harvest would be approximately Rp1,500,000. In the first year a smallholder farmer could earn Rp4,800,000 from 1,000 m² of kucai. Incomes for both crops would be higher in year 2 through years 5-7 (when plants would have to be re-established). Farmers in Ciampea and Nanggung agree that kucai offers higher potential returns, but it is more susceptible to insects and diseases. Given a choice, most farmers prefer to cultivate katuk. Local production also provides women an opportunity to earn Rp20,000/day by processing katuk.

4.2 Marketing challenges and opportunities

It is often difficult to scale up traditional agriculture production towards market-orientation to achieve economic development. Market-oriented agriculture production is often embodied with new technology, including heavy use of agricultural inputs, the adoption of which is frequently required to obtain the high returns promised by market-orientation. Transformation of traditional agriculture towards market-orientation is a formidable task, particularly if the benefits and risks are unclear. Although the cultivation of a crop, familiar or new, may be financially profitable, farmers are not automatically motivated to adopt market-production. This can be true even when the level of required technological innovation is simple. Smallholder farmers are often reluctant to adopt new technology or crops because of risk and uncertainty. Operating with limited resources, smallholders often lack ready cash to invest. From their perspective, the safe bet is to continue with the proven



Figure 5. One of the commercial kucai farms in Ciampea visited by Nanggung farmers to gain technical awareness and exposure

practices of their fathers and neighbors. Farmers feel they lack sufficient knowledge until the new crop technology has been proven. Most smallholder farmers prefer to wait for their innovative neighbors to take the lead in adopting the technology and assuming the risks.

Like their peers in many locations, smallholders in Nanggung face many constraints in producing and marketing crops. Most survive at or below the poverty line, with little ready cash and no access to credit. Their landholdings are small, less than 0.5 ha, of which most is dedicated to rice production for family consumption. Vegetable production is limited to upland fields and tree garden understories. Minimal labor and agricultural inputs are committed to vegetable production. Normally, farmers who comprise the working population only spend an average of 5.7 hrs/day on farming activities. Agriculture provides about 14% household incomes. Only 27% of Nanggung farmers have experience with vegetable production and marketing (Wijaya et al., 2007). Farmers have limited experience in marketing agricultural products and have to work off-farm to meet the needs of their families. Given these conditions it was not surprising that smallholder farmers were risk averse and took a wait and see attitude towards the adoption of new technology and crops.

Yet a number of Nanggung smallholder farmers were able to adopt the

market-oriented production of katuk and kucai. What made this possible? First, the production of katuk and kucai was profitable. There was high and stable demand in local, regional and national markets. Both species were indigenous and familiar to local farmers, but not widely cultivated. Although most Nanggung farmers were not experienced vegetable producers, the farmers who joined the trials were. More importantly, those farmers were willing to try the innovation, given the right support. There was strong facilitation from ICRAF and Winrock. Supportive market and technical linkages were developed. Local traders committed to buying the katuk and kucai produced at an agreed price.

Traders' commitment was made possible because ICRAF and Winrock enhanced their awareness of katuk and kucai demand and markets. Strong technical support was provided, including: awareness and access to quality germplasm, cross-visits to successful katuk and kucai enterprises, training in management practices, and establishment of production trials. Among the most important aspects of support was the mentoring provided by a successful farmer from Ciampea who intimately understood the conditions of Nanggung farmers, could speak directly to farmers' concerns (based on his experience as a farmer), and had a sincere desire to help. Katuk and kucai production in Ciampea was held up as an example, not for direct replication, as scale and other conditions differ, but to demonstrate that katuk and kucai cultivation was a viable innovation and that its adoption should be encouraged.



Figure 6. Market initiation training

5. Conclusions

Participating farmers, traders and other stakeholders considered the production trials and related support activities successful. Discussions within the group identified key factors that enabled farmers to adopt commercial-oriented katuk and kucai production systems: 1) a stable commodity price; 2) knowing the best management practices for commodity production; 3) inten-

sive early facilitation to identify and develop production and market opportunities; 4) clear farmer group goals and mission; and 5) informative success stories.

The positive summary does not preclude the acknowledgement of challenges in katuk and kucai production, post-harvest handling, and marketing. While best management practices have been introduced and are being utilized, farmers require additional experience in applying those practices under their resource limited conditions. Practices have been adopted, but require further adaption. Chief among production challenges is pest control and management. Pest problems that negatively impact yields and income affect farmers' motivation to maintain production.

Farmers are still primarily producers, preferring to sell at the farmgate. Katuk and kucai are perishable commodities. Both farmers and traders need to learn and apply improved post-harvest handling and storage practices that will enhance and maintain quality. Farmers need to combine improved production and processing practices to increase quantity and quality of yields to reach the minimum commercial orders that justify premium prices in lucrative markets and free transportation services from traders. Some stakeholders have alluded that farmer groups could assume transportation roles to capture more price margin. While this is possible, experience indicates that farmers should first focus on enhancing their capacity to produce reliable quantity and quality of commodities before diverging into broader market roles (Roshetko and Yuliyanti, 2002).

Figure 7. *Sauropus androgynous* post-harvest training



Similar to their farmer neighbors, local traders are risk adverse and have limited capital resources to invest in enterprise development. This situation is compounded by limited access to reliable market information and linkages at the regional and national levels. Currently, local traders lack the abil-

ity to establish long-term contracts with traders further up the market chain. Both local traders and farmers need to further enhance their access to market information and channels.

The production, processing, and marketing challenges mentioned here illustrate the imperfect market conditions of Nanggung. Those are the risks that farmers and traders must bear in order to participate in the market. If these risks become too great, farmers and traders may reduce resource allocation to the enterprise, returning to traditional forms of opportunistic vegetable production which yield products of limited quantity and quality, forfeiting prospects of participating in the quality-sensitive and lucrative national markets. Alternatively, farmers and traders might choose to cease participation in katuk and kucai enterprises, reallocating their limited resources to other on-farm or off-farm opportunities. Efforts are required to enable farmers and traders to continue improving the commercial orientation of their katuk and kucai production, processing and marketing systems. Strategies to sustain those efforts in the post-intervention period are required. Strategies should include training in adapting best management practices, specifically in pest and disease management, accessing and using market information, and farmer group dynamics for marketing.

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