

11 Women's role in the improvement of rice farming systems in coastal swamplands *

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Summary

Women assume a major role in rice cultivation and associated farm management in traditional agriculture. Rice farming systems in tidal and coastal swamp areas demand specific methods of labor intensive cultivation in which women's participation is still of paramount importance. These include seedbed preparation, transplanting, harvesting and processing of rice, vegetable and other secondary crop cultivation, fishing, animal husbandry and household management including child care.

This paper examines indigenous rice farming systems in tidal swamp areas of Kalimantan, Indonesia and women's role in their improvement. Present methods and future prospects for rice cultivation within multi-crop systems are analyzed. Possible effects of changes in labor and technology are discussed in relation to women's roles. Extension

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training in rice cultivation, secondary crop production and marketing is essential. Women's credit and labor cooperatives are advisable.

Introduction

Tidal and other coastal swamps have only recently been recognized as regions with potential for agricultural development. The role of women in improved systems of cultivation and management is uncertain.

Equitable incorporation of women into improved farming systems for tidal swamps demands an analysis of swampy farming systems and women's present role in them, an evaluation of new or improved technologies with attention to potential impacts on female allocation of labor, decision-making and control of production, and the effort to insure participation of women in training programs, including areas of access to credit, tools and technology.

These parameters for female participation in farming systems development are easy to list and difficult to obtain. Literature on traditional systems of coastal resource management is scarce. Research on improved rice and vegetable cropping in these regions has just begun. There is virtually no literature on women's participation in the tidal or tidally influenced swamp agriculture.

This paper focuses on coastal swamp farming systems of Indonesia. Women's participation in these systems is analyzed for labor. It contains an outline of tidal and inland coastal swamp environments, and their potential for agriculture. Settlement patterns along tidal waterways are described. General methods of rice cultivation are enumerated for the tidal/coastal zones of Kalimantan. Tree, vegetable and fruit crop production, fisheries and home industries of rice farming systems are assayed. Women's role is examined within the context of traditional 'tidal' rice farming systems in South and Central Kalimantan. Changes within the female labor force will occur with rice or secondary crop improvements. The impact of new cropping systems on women's livelihood and control of resources and women's role in the future development of coastal zone whole farm management is discussed.

Tidal and swampy coastal plains

What is commonly called a 'tidal swamp' is usually a composite of fresh and saline environments. A tidal swamp is a coastal wetland region which is directly affected by saline or brackish water tides on a daily or diurnal basis. These swamplands may undergo tidal inundation through all or part of the year. Tidally influenced swamps are fresh-

water swamps which experience fluctuations in water level as a response to tidal patterns. Other coastal swamps may undergo no observable tidal influence but are inland regions of deltaic plains which once were part of a tidal swamp. These areas experience flooding when rainfall is heavy and this water is backed up by tidal inflow. Coastal swamplands may also become dry and parched during the dry season.

In tropical areas, coastal swamplands are comprised of a number of environments. Mangrove swamps, peat swamps and other inland swamps predominate. All of these present diverse soil, water, climatic and floral conditions. These environments are fragile, and management strategies for resource preservation and use must be accordingly developed. Where agriculture is feasible, it must either be adjusted to these physical and biological factors or the prevailing environmental conditions must be changed to accommodate farming.

Coastal swamp regions are considered to be secondary regions for agriculture because of their environmental and economic constraints to development. In mangrove swamps brackish water inflow can be problematic through all or part of the year. Where tide fluctuation is great, crops can be submerged or affected for long periods. However, tidal inundation can also transport silt to levee areas, increasing soil fertility for agriculture. Peat swamps have low natural fertility, are generally acid, and under natural conditions are waterlogged and provide a poor substrate for crop roots. As with other inland mineral soil swamps of coastal areas, unanticipated seasonal flooding is common; flash fires in the dry season also occur. Acid sulfate or potential acid sulfate soils can occur in any of these environments as a surface or subsoil; this release of toxic elements can substantially reduce yields.

Rice farming systems in coastal swamplands

Although tidal and other coastal swamplands are secondary regions for agricultural development, indigenous occupation and spontaneous migration to these areas has occurred for generations. Voluntary expansion into these regions generally occurs with the decrease in more fertile, arable uplands and with diversification of farming systems to include swampland crops and fishing areas. Initial habitation may be either on a seasonal or permanent basis.

In all rice farming systems in swampy coastal areas farmers must both adjust to and modify their habitat. Most types of cultivation in these regions involve the control of water for drainage. Only limited tidally influenced areas use no water control. Drainage usually involves the deepening and lengthening of small feeder rivers and the creation of

canals which lead from inland areas into major waterways. Secondary or tertiary drainage systems are common. Drainage of swampy areas exposes soil or reduces water level to enable cultivation. The use of bunds or flapgates helps to retain or maintain constant water levels. Other methods of water control such as extensive diking or polderization require high capital input and highly organized labor. This is only possible through government aid and is financially unfeasible for many areas in developing countries.

Demographic maps promote the idea that coastal swamplands are sparsely settled in relation to their area. Most populations, however, tend to settle along river levees or adjacent to waterways. Populations are often dense in these environments while inland habitation is relatively sparse. Permanent settlements also tend to spread from areas which are rarely or only intermittently inundated with brackish water to more saline regions. This is reasonable considering the need for drinking and bathing water, the fact that most crops are intolerant of high salty conditions, and the increasing amplitude of tides near seas or oceans.

Land ownership and inheritance vary among ethnic groups, and may be based on traditional rights, religious dictates or government decree. In most coastal swamps hereditary use right is the norm, while title to land is a recent innovation. Increase in populations and the expansion of roads has prompted further settlement and title ownership of land.

On the whole, rice production in coastal swampland is primarily for home consumption. Yields are low and income is usually supplemented from secondary and tree crops or fishing.

Coastal rice farming systems in Kalimantan, Indonesia

The swampy lowland coasts of Central and South Kalimantan, Indonesian Borneo, have been settled for generations by Banjarese, Dayak and Buginese ethnic groups. In the 19th and early 20th century, these groups seasonally migrated to the tidal regions to fish and cultivate coconut groves. Rice farming systems today involve the incorporation of tall, strong-rooted, tidally resilient *Indica* varieties in less saline upriver or inland, tidally influenced areas. One crop is grown a year on these clay, silt or peaty soils (see Figure 11.1). Production is enough for subsistence and minor sales. Double cropping has been introduced but is presently applicable only within a limited region.

Except on river levees and higher ground, coastal swamp soils must generally be deeply canalized and row mounded to support crops other than rice or pineapple. This modification may involve peat subsidence and compaction, release of elements through burning and mulching.

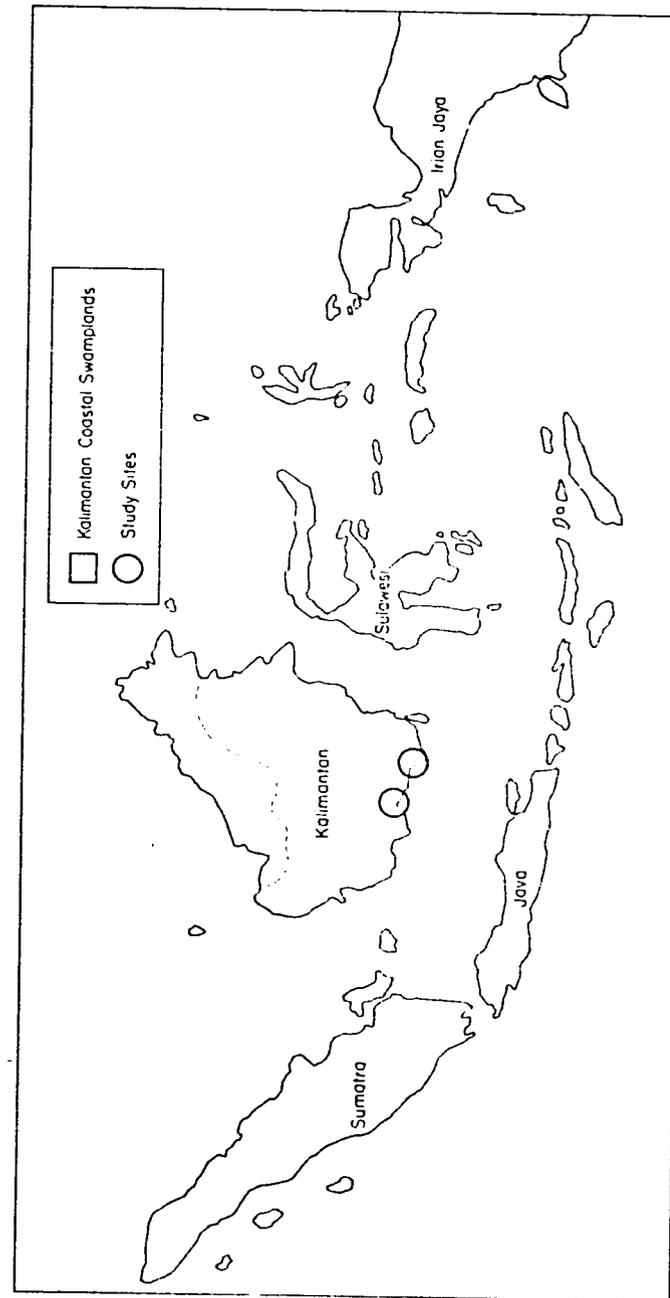


Figure 11.1: Map of Indonesia

reduction of acidity through leaching and aeration, and submergence of soils within the annual cycle and through mounding.

Other aspects of farming systems vary. Coconut is the major food cash crop of the Kalimantan coast and is exported to Java. Bananas and citrus are also prominent. Fish and shrimp are exported as far as Japan.

Land inheritance varies according to custom, religion and government decree. There are still vast areas of unclaimed swampland. Farmers can lay claim to forested land as soon as they open and plant it by reporting to the village head and county office. Titles to land can take years to process. In many areas land which is not farmed for three years may be claimed by a new owner.

Only titled land can be bought *per se*, but perpetual rights to cleared land or its tree products is frequent. Customary inheritance follows Moslem law: women receive one portion of land and men two. Women can own land, but farms that are jointly owned by a family are registered in the man's name.

Rice cultivation in higher tidal areas

These areas are under tidal influence and cleared of original mangrove vegetation. Soils are alluvial. In the dry season there is often brackish water inundation. During the rice growing period in the rainy season, water levels fluctuate with the tides, often rising and falling a metre or more a day. One rice crop is harvested each year. Land can be claimed, bought or borrowed; sharecropping or tenancy arrangements are uncommon. Later maturing varieties of 8-12 months are commonly used. Seedlings are transplanted 2 or 3 times to increase their height so that they can withstand tidal inundation. Plants are from 1½ to 2 metres tall. There is no soil tillage. Weeds are cut down, composted and spread on soil as green manure prior to final rice planting. Inorganic fertilizer and insecticides are rarely used. Weeding is uncommon since the tall spreading plants shade out all but the most persistent weeds. Most fertilization is obtained from siltation. Rice matures unevenly and must be harvested with a hand knife. Family labor predominates. Communal and imported wage labor is often used. Threshing is done by foot while winnowing uses wind to separate grains from chaff. Rice yields are high for coastal areas, ranging from 2 to 3 tons of unhusked padi per hectare.

Rice cultivation in tidally influenced and inland coastal plains

These areas undergo little or no fluctuation in water level in response to tidal cycles. Prolonged flooding often occurs. At these times water in fields frequently reaches depths of a metre. Brackish water rarely

inundates fields during the growing season. Soils may be alluvial or peaty. Rice growing sites are metamorphosed *galam* or freshwater swamp forest sites. Land is canalized and drained. One crop is grown and is final planted during the rainy season. Rice varieties mature in 5 to 11 months; the taller tidal types are still planted in poorly drained areas, while shorter, earlier maturing varieties are planted on well drained soils. Seedlings may be direct seeded or transplanted up to two times depending on flooding patterns, rice variety and terrain. Peaty soils are usually burned to promote compaction so that rice plants root well, and to provide fertilizer. Green manuring occurs but is not ubiquitous. Other fertilization or pest control is scarce. Rodenticides are commonly but inefficiently used. There is no soil tillage. Family labor is most important. Communal and wage labor are frequent at planting and harvest times. Rice matures unevenly, is harvested with a hand knife and is threshed by foot. Yields are low and generally vary from 3/4 tons/ha. to 2.0 tons/ha.

Double cropping

Double cropping has been introduced in South Kalimantan. A first crop of a modern variety is succeeded by a traditional rice. MV rice is planted in a farmer's field. During this time a traditional rice crop is transplanted from seedling beds to field borders. When the high yielding variety is harvested, the rice straw is cut down and the traditional rice immediately planted in the same field. The TV is harvested 4 to 7 months later. Some transmigration sites in Central Kalimantan also practice double cropping.

Rice sale

Rice production barely covers the subsistence needs of the ordinary farmer. Some rice is always sold at harvest time to pay back debts, buy upland food produce, or buy cloth or gold (for savings). A low rice yield can cause farmers to experience rice shortages months before their next rice harvest. Rice is owned and managed by the household, but male heads generally make final decisions on sales.

Other aspects of farming systems

Multiple cropping makes use of humanly modified soil and water regimes. In Kalimantan the cropping scheme is successional; mounds are built up in rice fields. Coconut is the major tree crop. Other tree crops include banana, mango, papaya, citrus, jackfruit and rambutan. Taro, yam, sweet potato, and cassava are major root crops. Production of

cucumber, squashes, eggplant, long bean and watermelon is high. Ginger, laos, lemon grass, and leaf spices are planted. Planting patterns are successional and are influenced by shading, soil hardness, changing pest populations and water conditions.

Other income producing farm activities include fishing, in inland swamps, drainage ditches, rivers, and along seacoasts. Chicken and ducks are reared for eggs and meat. Home industry includes production of fishing equipment, baskets, mats and thatch roofing or siding. Local forest or swamp products are collected; these include rattan, bamboo, nipah or sago palm leaves, resins and wood. Hunting occurs in isolated areas.

Off-farm labor; wage and 'in-kind' labor agreements

Both women and men, including families, often make seasonal trips to upriver areas to help in rice planting or harvest. This labor sometimes involves a reciprocal arrangement between households. A few men work in sawmills and coconut oil factories, but most off-farm labor involves ditching and harvesting of coconut; women's off-farm employment predominantly involves food crop marketing, excluding rice or coconut. In this case, proceeds generally accrue to the women.

Women's role in coastal swamp rice farming systems

In coastal swamplands in Kalimantan, women are actively involved in all aspects of agriculture and many auxiliary activities in farming systems. Tasks which require upper torso strength have less female participation (also see Deere 1977). For other jobs which require stamina and an intricate knowledge of cultivation techniques and farm management, women play an important role. This work includes labor in rice and less important cash crops, crop cultivation from seedbeds to harvest, and subsequent marketing. Rice is the major crop.

Women's participation in rice cultivation

The data for this study was collected from 60 farming households in Semuda Kecil village, Central Kalimantan, Indonesia. Households cultivate tidally influenced and inland peat areas. All family members aged 13 and over were considered to be able to join fully in rice agriculture. Results are illustrated in Tables 11.1 and 11.2. Table 11.1 breaks down female and male participation within the household. Table 11.2 addresses communal, wage and child labor.

Table 11.1 Women's participation in coastal swampland rice cultivation in Semuda Kecil, Central Kalimantan, Indonesia, 1981-82.

	Hoeing/ Ditching	Slashing Weeds	Preparation of Seedbeds	Transplanting	Planting	Weeding	Harvesting	Threshing	Winnowing
Women, Age ≥ 13 Years Participating in Activity	1	19	73	67	78	66	83	42	51
Men, Age ≥ 13 Years Participating in Activity	52	68	71	64	76	67	77	71	68
Percentage of Activities performed by Women	2	22	51	51	51	50	52	37	43
Percentage of Total Female Work Force	1	18	70	64	74	63	80	40	48

Survey Sample Size = 60 households
Total Survey Population = 351
Total Family Members Age ≥ 13 Females = 105, Males = 94

Table 11.2 Communal hired wage and children's labor utilization for coastal swampland rice cultivation. Household enumeration. Semuda Kecil, Central Kalimantan, Indonesia. 1981-82.

	Total Households Participating from 60	Hoeing/ Ditching in Rice Fields	Slashing Weeds	Preparing Seedbeds	Transplanting	Planting	Weeding	Harvesting	Threshing	Winnowing
Exchange and Communal Labor	29 48%	-	5 8%	-	1 < 2%	5 8%	2 3%	18 30%	15 25%	4 7%
Hired Wage Labor	28 47%	-	27 (male) 45%	-	-	8 (female) 13%	2 (female) 3%	10 (mixed) 17%	1 (female) < 2%	-
Households with Children 7-12 years Participating	27 45%	-	1 2%	8 13%	10 17%	14 23%	6 10%	16 27%	7 12%	3 5%

Survey Sample Size = 60 households

Women participate in all major aspects of rice cultivation. Labor is highest during the growing cycle of the crop; women constitute at least 50 per cent of the work force. Only in land preparation for agriculture do women assume a less dominant role.

Hoing and canalizing swampy soils is backbreaking work. Hoing is carried out in order to smooth uneven terrain. Ditching shallow canals in rice fields allows for runoff of flood waters. These are 'men's jobs'. Few women undertake them; when they do, they average only 50 per cent of men's productivity in performance. Only one woman in the survey carried out this task. Hired labor is often used.

Slashing weedy regrowth in rice fields prior to planting is also a strenuous job. Long-handled scythes or machetes are used. Hired labor is commonly employed. Like hoing or ditching, this activity demands upper torso strength. However, this activity is essential to rice farming, whereas rice can be grown without hoing or ditching. Slashing is always the preliminary task to rice farming. In poorer households which cannot afford hired labor for clearing, women often participate in this task. 22 per cent of the household labor force for slashing weeds is female.

Rice cultivation and harvest have the greatest amount of female participation. In all of these activities women represent over 50 per cent of the labor force within households. The tasks of planting and harvesting are the most time consuming part of labor. A full 74 per cent of women 13 or over join in planting and 80 per cent in harvesting, while seedbed preparation, transplanting and weeding consume 70 per cent, 64 per cent and 63 per cent of the female labor force. Ancillary activities in the rice field include cooking meals and fishing, tending vegetable or root crop plots and caring for children.

Post-harvest processing is recorded for threshing and winnowing. 37 per cent of the female survey population joined in threshing rice and 43 per cent at winnowing. There are various methods for winnowing, and women usually practice those that require less lifting strength.

Hulling, once performed by women, is now almost exclusively done by machine. Most women interviewed considered hand pounding tedious and time-consuming, and considered the 10 per cent tariff collected for hulling by machine worth the price. Rice flour is still pounded by hand in most cases.

Considering the time and effort involved in childcare and household and other whole farm activities, women contribute substantially to rice production in coastal swamplands. Table 11.1 does not include female labor involved in meal preparation or transport of rice and tools to and from the field. Women have a major role in both these areas, too. Women generally work in husband-wife teams.

Secondary crop cultivation relies on the expertise of women. Vegetable and root crops excluding cassava are almost exclusively women's domain in coastal swamp agriculture. Vegetable crops are planted at the end of or directly prior to the beginning of the rainy season to avoid risks of flood and drought. This also reduces conflict in labor use, since most vegetable cropping does not interfere with work in rice cropping. Cultivation occurs both in backyard gardens and on mounds in fields. Females prepare tree seedlings from cuttings, grafts and seeds, and participate in the fruit harvest, except for that of banana and coconut. Weeding and ditching of tree crops are primarily men's activities. Post-harvest production of copra, coconut oil and cassava chips is largely women's role. In-village marketing is the almost exclusive domain of women, who control and manage these funds. A large percentage of these are weekly and permanent market merchants.

Table 11.3 shows some of the results of a survey conducted to assay edible plant cultivation (coconuts and rice were not included). These lists included only 92 named crop varieties or species out of a probable 300 or more. Varietal types of taro, sweet potato, cassava and banana were reviewed. Households were encouraged to enumerate additional crops if possible.

The average household grew 40.5 species, predominantly vegetable, spice and fruit crops. If food crop varietal types were also counted this would exceed 50. One female informant (not included on the survey) enumerated over 200 edible plants which she cultivated or gathered. Other women informants helped to list over thirty varieties of banana, together with data on its cultivation in particular environments and the differential use of each variety for marketing, cooking and leaf quality.

In a more recent survey in four villages of South and Central Kalimantan, women's groups were interviewed with regard to within-village and market sale of their crops. Table 11.4 compares major food crops sold in each coastal swamp village. These villages vary in the type and amount of vegetables marketed. Much of this variation may be due to the length of establishment and ethnic group inhabiting a particular village. The oldest village, Lupak Dalam has been seasonally populated for at least 150 years, and permanently populated for the last 40 by spontaneous local Banjar migrants. Purwosari I is a government-settled Javanese village established by the Dutch in 1936. Tamban Raya was settled in 1956 by local Banjarese settlers after the Indonesian government opened a transport canal through the area. The most recently established government transmigration site, Tamban Lupak was opened in 1977 to Javanese settlers.

Intra-village sales are generally for only small quantities of a crop.

Table 11.3 Vegetable, fruit and root crop survey, Semuda Kecil, Central Kalimantan, Indonesia, 1981 - 82.

	Vegetables	Taro	Sweet Potato	Cassava	Spices	Fruits	Bananas	
							Major Var.	Other Var.
Number of Cultigens Listed on Survey	22	6	3	3	12	41	5	(household enumeration)
Range of Cultigens Listed per Household*	1-24	0-6	0-3	0-3	3-12	2-44	1-5	0-17
Mean Number (\bar{X}) Cultigens per Household	9.7	2.9	0.7	1.3	6.3	21.0	4.3	5.4
Standard Deviation(s)	4.4	2.0	1.2	0.9	1.8	7.0	1.0	4.0

Survey sample size = 60 households.

* Number of cultigens grown may exceed total cultigens originally listed in survey. Households were encouraged to enumerate other species. Mean number cultigen species (not varieties) grown per household, (\bar{X}) = 40.5 standard deviation = 11.8. Percent households selling bananas = 70.7. Percent households selling coffee = 58.3.

Table 11.4 Major vegetable, fruit and root crops marketed by women in South and Central Kalimantan (women's group interviews May 1983).

Crop Type	South Kalimantan		Central Kalimantan	
	Purwosari I	Tamban Raya	Tamban Lupak	Lupak Dalam
Vegetables				
Eggplant	X	X		X
Cucumber	X	x		X
Yellow squash	x	x		X
White squash	x			X
Corn	x		X	X
Loofa	x	x	X	X
Long beans	x	x		X
Cassava leaves	x	x	X	x
Sweet cup	x	X		X
Amaranth				X
Bitter cucumber				X
Celery leaf		x		x
Water spinach		x		x
Chilies		x		X
Soybean			X	
Spices				
Ginger	X	X		X
Laos (<i>Alpinia galanga</i>)	X	X		X
Kunyit (<i>Curcuma domestica</i>)	X	X		X
Kaneur (<i>Kaempferia galanga</i>)	X	X		x
Temu (<i>Curcuma</i> spp)		X	x	
Lemon grass	X			X
Major Root Crops				
Cassava			X	
Taro				
<i>Colocasia</i> esc.			x	X
<i>Xanthosoma</i>				X
Sweet potato or Yam			x	X
Fruit Crops				
Banana var.	X	X		X
Pineapple	X	X		X
Citrus spp.	X	X	x	X
Mango spp.	x	X	x	X
Jackfruit	X	X		x
Soursop	X	X		X
Water apple spp.	x	x		X
Star fruit	x			X
Kasturi		x		X
Papaya	x	x		X
Guava	x			X
Watermelon				X
Rambutan	X	X		
Coffee	x	X		

X = frequently sold in weekly or permanent workers
x = frequently sold within village

However, many women sell a wide variety of vegetables, fruits and spices within their villages on an irregular basis to neighbors or intermediary buyers. Squashes, cucumbers and eggplants are major vegetable crops. Mangoes, rambutans and other small fruits are marketed in season. Spices are grown all year round but are usually harvested only once or twice a year. Coffee is irregularly sold. Larger quantities of food crops are sold through weekly or permanent markets of larger towns. Women entrepreneurs generally specialize in vegetables, spices and small fruits. One woman explained that she derived US \$100 (approximately 30 months wages) from the sale of root spices.

Fishing

Since settlements are located on waterways and frequently include major tracts of inland swamps, fish and shrimp are predictably an important part of the diet. Sea fishing and fishing along major rivers with trawls and nets are men's tasks. Women obtain fish and shrimp for consumption and sale from canals, rice fields and swampy depressions, mainly using poles, baskets and traps. Fish pond culture is occasionally practiced.

Animal husbandry

The number of chickens and ducks that are tended varies from household to household and throughout the year. Except in cases of large flocks which require household effort, women generally manage and control the care and feeding and sale of these fowls. Birds both provide eggs and act as 'walking investments' since the price of meat is high, and birds can be sold as necessity demands.

Home industries

Women commonly weave mats, baskets, fans, sun hats and thatch palm siding and roofing which are sold to nearby markets. One village in Central Kalimantan shipped thatch siding as far as Java. Cooked goods such as cakes or rice dishes may be hawked from door to door. In regions further from oil processing plants, women process, bottle and sell coconut oil.

Off-farm labor

Off-farm labor for women farmers is carried out mainly in the areas of peddling, marketing and reciprocal planting and harvesting arrangements with other villages. It is difficult to assess returns to much of

women's local labor. Many products are traded and sold in small quantities on an irregular basis and rarely enter the market economy.

Women's role in the improvement of coastal swamp rice farming systems

The improvement of coastal swamp rice farming systems involves the integrated resource management of the total system with an emphasis on increasing rice production. Projects which focus on increasing food production through coastal agriculture improvement must attend to changes in the division of labor which occur with the implementation of new technologies. In past agricultural development, these effects have not always been positive for women. This has often resulted in decreased female participation in control of capital, loss of individual income and autonomy (Cloud and Overholt, 1982; Castillo 1977; Whyte and Whyte 1982).

There has been little attention directed toward women's participation in Indonesian policy planning for coastal swamp rice improvement. Technical assistance, farming inputs and credit systems for intensified single and double cropping have been organized within male groups of farmers. These include projects both for indigenously settled areas and transmigration sites.

As has been illustrated for Central and South Kalimantan, women's role in all aspects of coastal farming systems has been substantial. However, with the prevailing attitude that men as 'heads-of-households' are the logical recipients of extension services, it is likely that women's management capacities will decrease. Exclusion of women from decision-making for choice of rice seed, and the use of technological inputs will reduce the capability of the total farming community. The repercussions will be especially severe in households headed by women and predominantly female households, where adult male members pursue fishing, forestry or trading as their major occupation.

Impacts of rice improvement programs on labor

In Indonesian tidal, tidally influenced and inland swamp regions, the impact of new rice technologies on labor is still minimal. Rice seed varieties which have been introduced (IR 5, 36, 42) are adaptable to a limited region of coastal swamps where there is little risk of brackish water inundation and where peats are shallow (Collier et al. 1981). In farming villages surveyed in South and Central Kalimantan, double cropping of rice using a modern variety as a first crop was implemented

on 0-10 per cent of the rice field, and yields were low. Females concurred that their labor increased, but that return to labor was low because of lack of pest control and inability of rices to withstand environmental problems.

If improved rice varieties are to be introduced to increase production these must be tailored to specific microenvironments. Characteristics which will increase rice production include earlier maturity (4 or 5 months), elongation ability or submergence tolerance, reduced susceptibility to pests and disease, salinity or acidity tolerance, even maturing of panicles and reduced shattering. Rice will be planted direct from seedling beds. Erect-leaved, moderately tall (125-135 cm) types will both be able to withstand higher water tables and help to suppress weed regrowth. New varieties can increase yields to 3.0 tons/ha., but stable and sustainable yields are not possible without additional land preparation and maintenance, and inputs of fertilizer and pesticides.

Modifications in new rice technologies will affect labor in the following areas.

Substitution of tools and techniques

New rice varieties may incorporate characteristics which demand substitution or change in labor, agricultural tools and work techniques. Present harvesting is done with the hand held finger knife, which is used to harvest only ripened panicles of the unevenly maturing, shatter-proof traditional rice variety. Women provide a slight majority of the labor force in this area. The introduction of evenly maturing, non-shattering varieties is associated with harvesting using the sickle. In other parts of Indonesia sickle harvesting has become almost exclusively a male task (Collier et al. 1973). Foot threshing of easily shattered traditional rices will almost certainly be replaced by beating or machine threshing. Small scale technology such as weeders may also be incorporated, and access to the credit for and use of this technology is at present uncertain.

Extensification

Modern rice varieties with tolerance to adverse soil and water conditions of coastal swamps will be employed together with the improved physical parameters derived from better drainage and irrigation systems. This will allow rice cultivation to expand into swampy areas, and open new regions to settlement. Continued increases in population in proximity to longer-established farmers can supply wage labor to these areas. While it is expected that slashing will continue to be a source of male labor, and planting, weeding and

harvesting all are predominantly female, both sexes are able to carry out these tasks, and future wage labor patterns are therefore unclear.

Intensification

For improved rice farming intensification of labor includes the absolute increase of labor per hectare together with the concentration of work loads during specific periods. The intensification of labor utilization can promote increased use of hired labor in relation to household labor (Smith and Gascon 1979). In many areas women have equal abilities to participate as wage labor as men do. These areas include weeding, planting, crop fertilization and protection, winnowing and marketing of rice. If rice cropping intensification does promote the increase of hired labor in coastal swamps, there is every reason to assume women's work cooperatives can be formed to insure their continued participation.

Diversification

Inputs and technology involved in fertilization, weeding and plant protection will diversify tasks within rice agriculture. With sufficient incorporation into extension program training and credit systems, women's benefit from participation in these areas is likely.

Women's role in other areas of rice farming systems

Continued problems in the stability and sustainability of rice yields are not likely to be overcome immediately. In Indonesia, a continued reliance on coconut export and secondary food crop production is foreseen. At present, government sponsored programs in coconut, clove and cashew have met with limited success, since methods to cultivate these crops in tidal swamps have been insufficiently developed. Government programs for coconut have succeeded best where they mimic indigenous cultivation. These programs have been directed toward men who, however, are almost exclusively the coconut cultivators.

Aside from rice, women's contribution to multiple cropping systems is obviously in the area of vegetable, spice, root and minor fruit tree crops cultivation. As far as is known, there is no study which completely enumerates these crop varieties, characteristics and cultivation or measures their production, consumption and sale. There is also no present plan to promote production and marketing of crops other than

legumes, cassava and corn. In the past, extension work for these latter crops has been afforded to men.

Chicken and duck breeding and aquaculture projects are presently in the planning stage for coastal zones.

Suggestions for future planning

The role of women in the improvement of rice farming systems of coastal swamplands ultimately depends on their integration into the areas of agricultural decision-making and control of income derived from production as much as their absolute participation in agricultural tasks. Equity for women should apply both within the household and among households so that poorer rural women can derive benefits as well as richer ones. Attention should be directed not only to the amount of work women receive but its quality and prospects as an income generating activity. This depends on the efforts of government planning through policy makers and extension workers to include women in development programs. In general, policy must meet the following criteria: (1) initial assessment of women's present role in farming systems, (2) involvement of women into project decision-making from surveys through project design and implementation, (3) inclusion of a female component in extension projects which affords them direct access to project benefits including credit and inputs, (4) periodic evaluation to insure continuing benefit to women's social and economic status, and (5) publication and/or dissemination of information to all parties concerned with this area of agricultural development, including feedback to women farmers themselves.

Using these guidelines to project development, the following suggestions are made to improve major women's roles in rice farming systems of coastal swamps.

Women's labor cooperatives within rice agriculture

Reciprocal planting and harvesting arrangements with both wage labor and 'in kind' payments of cash or rice are already in effect in coastal swamp agriculture. The formalization or creation of women's cooperative groups for intensified rice cultivation would help to preserve and extend predominance in tasks such as seeding, planting, weeding and crop care and protection, and guarantee a continued source of income which is received and allocated by women. These cooperatives could operate on intra and inter-village levels.

Increased use of female extension workers in all areas of farming systems production and directed encouragement of women's participation in rice improvement programs in coastal swamplands

Training must be adjusted to women's ability to participate since constraints such as male avoidance patterns, household labor or seasonality of labor may prohibit attendance (Whyte and Whyte 1982). Access to credit and inputs on an individual rather than a household basis can provide women with greater control of the products of their work. In the swampy areas, widespread projects for rice improvement are only beginning to be implemented. Immediate attention to the above areas is advised.

Vegetable, spice, root and minor tree crop production programs for women

Coastal swamps have great potential for the export of vegetable and other secondary food crops. Varieties and cultivation patterns need to be investigated. Women are the principal cultivators of these crops and are involved in processing and marketing. Nutrition of children is also related to home production. Secondary crop production programs should be implemented to promote continued participation and market expansion.

Coastal swamplands are environmentally complex and problematic regions. Information on local agricultural practices for these areas is incomplete. Virtually no attention has been paid to women's role in farming systems. The organization of female labor and development programs such as the above will insure that women's role in the improvement of rice farming systems in this region is an important one.

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