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Toddy palms in the paddy field: An alternative economy of farmers in Pattan Village, Taungoo Township*

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Abstract

This paper analyzed the role of toddy palm in the economy of rural people from new perspective. Since toddy palms are found in the paddy field comparative analysis has made between toddy, paddy and peas. The study focused on three points: How toddy palms effect on the paddy production? What are the economic cost and benefit of toddy palm located in the paddy field? How should we consider toddy palm for the future socio-economic development of Pattan Village? Data used in this paper were derived from ground surveys and open and structured interviews conducted to all household heads of Pattan Village. The analysis results showed that there is no significant evidence that toddy palm could have an effect on the production of paddy from the present distribution pattern. Annual profit that could be gained from the products of toddy palm is higher than paddy and peas. If toddy palms are fully utilized to its capacity it could become an alternative economy for the development of farmers and rural areas.

Keywords : Toddy palm, Farming, Alternative economy, Taungoo Township

Introduction

Toddy palms are mainly found in middle and upper parts of Myanmar where climate is dry and hot. Spatially, toddy palms are grown in Myingyan, Pakkoku, Kyaukpadaung, Yesagyo, Mahlaing, Taungthar, Mandalay and Magwe Townships (Thetkatho Sein Tin, 1969; U Kyi, et al., 2005). The whole development stage of toddy palm from germination of seeds to adult plants and the whole parts of toddy palm from roots to top are useful to human being (Myat Thi Tar, 2006; Daw Than Than Mar, 2005). Its usage, however, varies based on the given natural conditions and perception of people living in the area.

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Research Background

Toddy palms stand as one of the major economies in the Dry Zone Areas (U Kyi, et al., 2005; Daw Than Than Nu, 2004) where natural environment is harsh and hostile. Accordingly, both public oriented literatures (Thetkatho Sein Tin, 1969) and academic studies (Ma San San, 1977; U Kyi, et al., 2005) gave emphasis on the socio-economic conditions of toddy workers. All studies explained the nature of toddy palm and the process of toddy-juice collection, jaggery (palm sugar) production, and socio-economic life of toddy workers and gave suggestions for the development of toddy industry and toddy workers. Botanists emphasized on the usefulness of toddy palm (Myat Thi Ta, 2006; Daw Than Than Mar, 2005; Mg Thynn and Pye Phyo Thet, 2005) from Ethno-botanist point of views. Recent studies (U Kyi, et al, 2005; Tin Aye and Khin Maung Zaw, 2006) emphasized on the problems of fuel-wood used in jaggery (palm sugar) production process and forest depletion and environmental degradation.

Abundant rainfall and fertile soil permit growing of paddy as a major crop in Taungoo area. Some village tracts such as Senseik and Htangone, however, are historically covered with toddy palms. Those toddy palms are mainly found in the paddy fields rather than as a separate toddy forests. The major economy of above village tracts is paddy cultivation. Since the environmental conditions favour for agriculture, toddy palms are traditionally used as extra income in some households by means of production of toddy-shoot. There are two types of toddy palm: male and female. Although female toddy palm could produce both toddy-shoot and toddy-juice, male toddy palms could be used only for production of toddy-juice. Due to many reasons many male toddy palms and female toddy palms remained out of production in the study area.

With the practice of market oriented economy, the existing agriculture lands are utilized more and more intensively. Double cropping of paddy is carried out where irrigation water is available. Paddy and peas double cropping is conducted in some areas of Taungoo where irrigation is not possible. In addition, agriculture lands were expanded due to rising price of peas (for export). Some fallow lands located near the drains and roads were changed into agriculture lands. It means that land use competition among crops and land use intensity on available lands are intensifying very recently.

Since toddy palms are grown (naturally or intentionally) within the paddy fields, government do not imposed tax on it. Thus, it is free for farmers

to decide whether to cut it or leave it. If the farmers think it is hampering the paddy cultivation he will cut off toddy palm. It is necessary to take about 15 to 20 years for a toddy palm to be able to collect toddy-juice or toddy-fruits. A toddy palm could be continuously used for production for more than 60 years[1] (U Kyi, et al., 2005). Very recently, however, toddy palms were easily cut for a petty value or wholly wipe out for construction of canals. Although cutting of a toddy palm could be done within an hour it will take nearly one generation to become a productive toddy palm. Therefore, it is necessary to examine the role and contributions of toddy palms in the economy of rural areas.

It is necessary to consider the major economy of the study area in examining the role of toddy palm in the socio-economic development of rural people, because it is quite different in the nature of environment that toddy palms are grown and the perception of people on the toddy palm between Dry Zone and Taungoo area. At this point, the trend of this paper will greatly differ from previous studies where the emphasis was on the usage, process and economy of toddy palm. In addition, all previous studies focused on Dry Zone Area and no particular attention was given to the climatic transitional zone between dry and wet areas.

Research Problem

Paddy is the major crop contributing to the agro-based economy of Myanmar. It is grown throughout the country where environmental conditions are good. Environmental conditions of Taungoo are favourable for paddy cultivation. It is also a policy crop. Therefore, it is necessary to examine the effect of toddy palm on paddy field based on two points: "*How toddy palms effect the paddy production*?"; "*How many areas could be lost due to the presence of toddy palm?*"

Then, it is also necessary to examine the *economic cost and benefit of toddy palm located in the paddy field in comparison to paddy and peas cultivation* before deciding whether to cut or leave it.

Based on the results of above analysis the role of toddy palm should be considered for future socio-economic development of Pattan Village: "*How*

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[1] Daw Than Than Nu (2004) mentioned that a toddy palm could produce toddy juice more than 80 years.

much toddy palm can contribute toward the rural economy? " and "*How should we manage to get full contribution of toddy palm to the rural economy?*"

Data and Methods

To examine the effect of toddy palm on the paddy plants two case studies were selected from the village. Then, the length and branching rates of paddy plants from each area were measured with reference to the distance from the toddy palm before analyzing their relationships by linear regression analysis. To examine the amount of paddy land that should be lost due to the presence of toddy palms, aerial distribution of toddy palms and paddy fields were measured for the above two case studies by using Trimble GPS Measured data were analyzed by using ArcView GIS 3.3 software.

Costs and benefits of toddy palm was compared to paddy and peas cultivation by using the data derived from the structured interview conducted to the 31 villagers (all household in the village) and open interviews with four toddy workers, and data derived from aerial measurements.

Possible solutions related to the toddy palm and socio-economic developments of rural area were discussed based on the present situation of toddy palm and toddy products, and perceptions of villagers to the toddy palm.

Geographical Background of Study Area

Pattan Village (study area) is located near the Taungoo University in Sinseik Village Tract within Taungoo Township, Bago Division (Fig. 1). Average temperature and annual rainfall are 22° C (71.6 ° F) and 1927.86 mm (75.89 inches), respectively (Ma Thin Thin Khine, 2004). It receives higher rainfall and lower temperature compared to Dry Zone where the majority of toddy palms are thriving. Since the environmental conditions (especially, climate and topography) are favourable, majority of households (55%) are engaged in farming. Some people are engaged as daily wage earners (25.8%) since they do not have their own farmland. Toddy worker occupied 6.5% of households. Then, each of the government servants and service men occupied 3.2% of households. The rest 6.4% of the households falls into other occupational group.

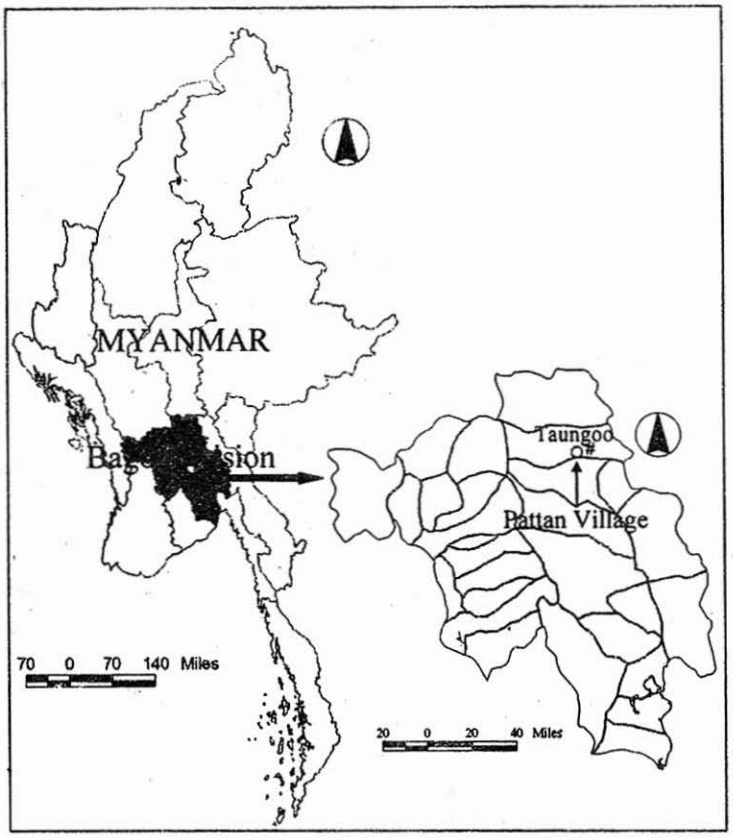


Figure (1) Location of study area

Source: Department of Geography, Yangon University.

There are 31 households in Pattan Village. Of them, 24 households possess various amount of toddy palm ranging from 2 to 150 trees. Five households own more than 100 toddy palms. There are 1345 toddy palms in Pattan Village. Of them, toddy-juice could be extracted from 943 toddy palms while 402 are young toddy palms. Of the 943 matured toddy palm, 87.49 percent (825 trees) were already extracting toddy products (toddy-juice or toddy-shoot or both), while the rest (118 trees; 12.51%) were not used for production (Table 1). Male toddy palm could produce toddy-juice only and female toddy palm could be used for both production of both toddy-juice and toddy-shoot. Production of toddy-juice needs skilled male labor while production of toddy-shoot could be done by the farmer's wife or family

members. Due to difficulties in availability of skilled toddy worker many male toddy palms are not used for production. Majority of the toddy palms were located on the embankments of the paddy fields.

Table (1) Population of toddy palm in Pattan Village

	Extract	No extract	Total	Young
Male	433	106	539	402
Female	392	12	404	
Total	825	118	943	402

Source: Structured interview results (July to September 2006).

Effect of Toddy Palm on the Yield of Paddy

According to structured interview results, 5 out of 17 farmers answered that toddy palm could affect the yield per acre of paddy by means of casting shadow, absorbing soil fertility, falling of branches and fruits into the paddy fields. Other farmers do not think that toddy palm could have an effect on the yield of paddy. U Kyi, et al. (2005) and Ma San San (1977) pointed out that toddy palms growing on the edge of *Ya* land (dry land) do not have an effect on production of *Ya* crops. Its effect on the paddy cultivation is not yet mentioned in previous literatures.

It is generally accepted that yield per acre of paddy is based on the branching rate of each paddy plant since seeds bearing from the branch have better quality and more braches could generate more paddy (Aung Kyaw, et al. 2007). If there is a competition for soil fertility (sharing of soil fertility) between toddy palm and paddy plant, the plants located near the toddy palm will have lower rate of branching.

In addition, shadowing effect could make the paddy plants to become long in stature and weak in branching. Paddy plants affected by toddy palm will receive relatively less sunlight for photosynthesis. As a result, yield per acre of paddy will be low. Relationships between these two dependent variables (average height of paddy plants and branching rate) and one independent variable (distance from toddy palms) were examined from two case studies by using linear regression analysis.

A Case Study 1- In the first case study, toddy palms were located on the embankment of paddy field. Paddy plants growing (at 6 inches interval) from the embankment to the open field were selected at 7.5 feet interval and its branching rate (based on the original plant and newly developed branches) and average heights are measured. The measurements were conducted 4 times in parallel position. The relationship between distance from toddy palm and branching rates of paddy plant shows a negative relationship (Eq. 1).

$$Y = -0.5027x + 385.7 \quad \text{(Eq. 1)}$$

It means that if distance from the embankment of toddy plant increase the branching rate of paddy palm will decrease. Correlation coefficient value (R^2) shows as 0.0274. This value is too low to draw firm conclusion. Therefore, it could be concluded that **there is no statistically significant evident that the presence of toddy palm have an effect on the paddy plants.**

Then, the relationship between distance from the toddy palm and height of paddy plant was considered. It could be theoretically assumed that if the paddy plants were affected by the shadows of toddy palm its height would be taller. The linear regression analysis result reveals negative relationship (Eq. 2).

$$Y = -0.0053x + 20.431 \quad \text{(Eq. 2)}$$

It means that if distance from the toddy palm increase the height of the paddy plant will decrease. It reveals shadowing effect of toddy palm on the paddy plant. Its variance (R^2), however, is very low (0.01) to be able to draw sound conclusion. Therefore, it is fair to conclude that although the heights of the paddy plants which are closer to the toddy palm seem to be taller than the ones further away due to shadow effect, it is could not be statistically proved.

A Case Study 2- In the second case study, toddy palms are found on the embankment while toddy forest is also located on the other side. Distance from the embankment of toddy palm, height of paddy plant, and branching rates for each selected locations were measured similar to case study 1. The results of linear regression analysis revealed that there is positive relationship between distance from the embankment of toddy palm and branching rate of paddy plants (Eq. 3).

$$Y = 2.2427x + 445.77 \quad \text{(Eq. 3)}$$

The strength of correlation (R^2), however, is weak (0.16) to conclude the relationship significantly. In addition, toddy forest is located in the opposite side of measurement. Thus, it is difficult to conclude that branching rate increase with the increasing distance from the toddy palms.

The relationship between the distance from toddy palm and height of the paddy plants reveals negative correlation with a weak strength (R^2) of 0.06 (Eq. 4).

$$Y = -0.0118x + 21.807 \quad \text{(Eq. 4)}$$

If considered from the presence of toddy forest in the opposite side it is difficult to conclude significantly that the paddy plants located near the toddy palms are taller than the plants that is away from the toddy palms.

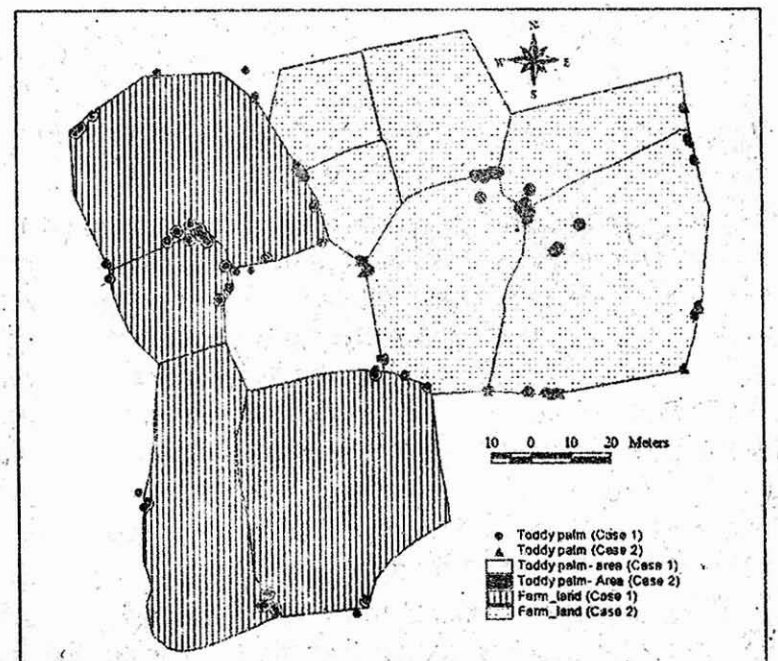
Therefore, from Figure (2) and Figure (3) it can be concluded that "there is no significant evident that toddy palms have an effect upon the yield of paddy plants". It is possible that the roots of the toddy palm do not run too far to be able to utilize the fertilizers in the paddy field. It is also evident from the point of view that toddy palms are surviving in Dry Zone where there is scarcity of water and no fertilizer inputs.

A toddy palm has an average height between 60 and 80 feet (Thetkatho Sein Tin, 1969). Due to its height, nature of leaves (only located at the top) and variation in inclination of sun angle (throughout the whole day), paddy plant located under or near the toddy palms are not covered from the shadow of toddy palm for a long time. As a result, shadow effects on the paddy plants are not clearly seen in the analysis results.

Area could be Affected by Toddy Palm

The second question is related to the point that "How much of paddy land areas could be lost due to presence of toddy palm if toddy palms have a complete effect on the paddy field?" Aerial analysis was conducted based on distribution of toddy palm and paddy fields to identify this point. As a procedure, location of paddy field (polygon) and toddy palms (points) were recorded for two case studies by using Trimble GPS. Recorded spatial database was converted onto ArcView 3.3 GIS software for analysis. Then, 5 feet radius buffer was constructed for each toddy palm before calculating the area that could be lost due to presence of a toddy palm.

The results of case study 1 and 2 are shown in Figure (2). Case 1 and case 2 encompasses 2.01 acres and 1.98 acres of farmland, respectively. Case 1 possesses 42 toddy palms. Of them, 6 are located on the outside of his farm. The rest of the toddy palms (36) are located on the embankment of the paddy field. If a toddy palm is assumed as having 5 feet (1.524 meter) radius, the area could have a complete effect on the paddy land by all toddy palms is calculated as 0.03 acre or 1.65 percent of the total area in case 1 farmer.



Paddy land lost due to toddy palm (with 5 ft. radius buffer)

	Case 1 (acre)	Case 2 (acre)
Total Land	2.01 (0.8134 ha.)	1.98 (0.8013 ha.)
Land lost	0.03 (0.0121 ha.)	0.04 (0.0162 ha.)
Lost percentage	1.65	1.80

Figure (2) Farm land could be lost by the presence of toddy palm.

Source: Based of author's measurements and calculations.

Case 2 farmer possesses 39 toddy palms. All toddy palms are grown in the paddy field. All toddy palms except 5 are grown on the embankments of the farm. Calculation results (same as in case 1) show that 0.04 acres or 1.8

percents of farmland could be lost if a toddy palm could completely have an effect on the paddy land with 5 feet radius.

From above two case studies, it is clear that the farmland area lost by the presence of toddy palms is less than 2 percents. Majority of toddy palms are located on the embankments of farms which have a width of nearly 2 feet. If one subtracts the area that is necessary for embankment from the land area lost by toddy palm, the effect of toddy palm on paddy plant could be further reduced. Furthermore, it is necessary to examine lost of income to the farmers due to the presence of toddy palm.

Comparative Economic Cost and Benefit Analysis between Toddy and Farm Crops

Paddy is major crop in all farmlands located in Taungoo area. It is also grown as a second crop where irrigation is practicable. In some areas where irrigation water is not available, peas is grown as a second crop. Growing of peas is introduced as a second crop very recently and it is mainly grown on fertile soils in the study area. From the structured interviews results it is understood that although 102 acres of paddy cultivation are carried out in study area, only 68 acres (66%) were grown peas in 2005.

Cost and Benefit of Paddy and Peas

The comparison between toddy and other farm crops are made based on the cost and benefits of farming derived from the structured interviews results conducted to the villagers.

Table (2) Average cost of an acre of paddy and pea cultivation in 2005

Categories	Paddy		Peas	
	Cost (Kyat)	Sample	Cost (Kyat)	Sample
Seeds	5824	17	16483	15
Fertilizer	14866	17	10125	4
Pesticide	0	17	3642	13
Labour	13997	17	6473	15

Categories	Paddy		Peas	
	Cost (Kyat)	Sample	Cost (Kyat)	Sample
Machine	6357	7	3392	13
Cattle	9467	15	10400	11
Other costs	0	0	2500	3
Total cost	45657		39020	

Source: Calculated based on structured interview results (July to September 2006).

Notes: 1. Average cost for one acre of paddy is 45657 Kyats with STDEV of 13990.78 Kyats.

2. Average cost for one acre of pea is 39020 Kyats with STDEV of 12497.91 Kyats.

Table (2) shows the cost of cultivation for an acre of paddy and peas. Cost of seeds, fertilizer, pesticide, labour, machine, cattle, and other costs used in the paddy and peas cultivation are considered. Structured interviews results reveal that pesticide is not used in paddy cultivation. An acre of paddy cultivation cost about 45657 Kyats while peas need 39020 Kyats from land preparation to harvesting. From the standard deviation values, those values are usable to represent the cost for cultivation on an acre of paddy and peas.

Table (3) shows the average cost, income and profits of an acre of paddy and peas. The price of paddy and peas varied based on the season and year of the crops sold. All interviewees are requested to answer the situation of 2005. Most farmers sold out their paddy during November and January and their average price of selling time was 1994 Kyats per basket (ranging between 1500 Kyats and 3000 Kyats). An average yield per acre of paddy is about 60.1 baskets with standard deviation of 8.3 baskets. Thus, total income and profit that a farmer could be gained from an acre of paddy cultivation are 119875 Kyats and 74218 Kyats, respectively.

Table (3) Average cost, income and profit of an acre of paddy and peas in 2005

	Avg. yield/acre (basket)	Price/ Basket	Income (Kyats)	Cost (Kyats)	Profit (Kyats)
Paddy	60.1	1994	119875	45657	74218
Pea	7.7	18822	144931	39020	105911
Total			264806	84677	180129

Source: Structured interview results. (N=17)

All farmers sold out their peas during April and June. They received an average price of 18822 Kyats per basket (ranging between 16000 Kyats and 20000 Kyats). Average yield per acre of peas is 7.7 baskets. Thus, the total income and profit from cultivation of an acre of peas are 144931 Kyats and 105911 Kyats, respectively. Therefore, if a farmer grows both paddy and peas as double cropping he could earn 264806 Kyats and could make 180129 Kyats profit in one year.

Cost and Benefit of Rented Toddy Palm

Cost and benefit of paddy and peas cultivation compared with the cost and benefit of toddy palm cultivation by using above two case studies. Table (4) shows the comparison of toddy land and farmland in terms of cost and benefit. In case 1, there are 42 toddy palms. Of them, 33 could be used for production. If a toddy palm was rented for one year it could earn 500 Kyats. It is not necessary to feed fertilizer or take care of the toddy palm. Therefore, if all matured toddy palms (33) are rented the total income would be 16500 Kyats. To compare the cost and benefit between toddy palm and cultivated crops we could assume that toddy palm area is cultivated by paddy and peas. In that case, an acre of farm land could gain 180129 Kyats (Table 3) if it is double cropped with paddy and peas. Thus, 0.03 acres of land that could be lost (Fig. 2) by the presence of toddy palm could make a profit of 5969.5 Kyats. Thus, by growing toddy palm (by keeping the toddy in present position) a farmer could earn a profit of 10530.5 Kyats (16500-5969.5) more than growing of paddy and peas on the same area.

A Case 2 farmer own 1.98 acres of land and 39 toddy palms. Twenty-five toddy palms could be used for production and could earn 12500 Kyats if he rented all of these matured producible toddy palms. The areas lost by all his toddy palm is 0.04 acres (Fig. 2). If paddy and peas are grown on this area it would profit 6411.0 Kyats a year. The profit difference that could be made by growing toddy palm (or keeping toddy palm in present positions) instead of growing paddy and peas is 6089 (12500-6411) Kyats.

Table (4) Profit comparison of toddy palm and farmland usage

	Toddy palm				If paddy and peas** (b)	(a) – (b)
	Total	> 20 Yrs.	< 20 Yrs.	Income (Kyat)* (a)		
Case 1	42	33	9	16500	5969.5	10530.3
Case 2	39	25	14	12500	6411.0	6089.0

Source: Calculated based on field observations and structured interviews.

Notes: * Calculate based on 500 Kyats per toddy palm per year for > 20 years old toddy palms.

** Profit gained by paddy and peas double cropping is calculated for the area could be lost by

presence of toddy palms (Fig. 2).

In both cases, it is more profitable to keep toddy palm in present position instead of growing paddy and peas in the same area. Case 1 farmer could gain 10530 Kyats more from toddy. If young toddy palms become matured to the age of production the profit could be higher. In addition, if toddy works (toddy-shoot and toddy-juice production) are conducted more intensively by farmer or his relatives the profit would be higher.

Economic Potentials of Toddy Palm

Above section shows that if toddy palms are kept in present position it is more profitable than paddy and peas as double cropping in the same place. This section will discuss about the economic potential of toddy palm. It is assumed that "although an item is valuable it could not be considered as a resource when people do not recognize its value". Therefore, economic potential of toddy palm will be analyzed based on the perception of local people and actual productivity of toddy palm.

Perception of Local People to the Toddy Palm

At present toddy palms are easily cut or destroyed in the study area as mentioned at the beginning of this paper. Of 31 interviewees, 6 use to cut or sell their toddy palms by themselves. An average cost for a toddy palm is 6000 Kyats. Majority of the toddy palms are used for construction of paddy storage bin and bridge while others are simply cut for the reason of disturbance to paddy cultivation..

Although they cut toddy palm for many reasons, contribution of toddy palm to their household's economy is well recognized. Out of 31 households 25 (80.6%) accepted that toddy palms are contributing to their economy in one way or another. Majority (83.9%), however, do not want to grow toddy palm on their lands. Some farmers (16.1%) answered that they want to grow toddy palm for their children and future household's economy.

Farmers gave various reasons for not growing toddy palms in their land. Thirty-nine percent of the despondences gave main reason as lack of space for growing of toddy palm and another 39 percent of the interviewees are not interested on it. Other farmers (22%) answered that toddy palm could have an effect on paddy cultivation.

Above results revealed the point that "real values of the toddy palms are not fully recognized by the local people". Since primary economy is cultivation of paddy and farmer could survive on it, the potential of toddy palms are not fully exploited. As a consequence the value of toddy palm is not fully understood by the local people.

Sixteen out of 19 large toddy palm owners received toddy palms from their ancestors and only 3 farmers grow it in their lifetime. Farmers in the area traditionally use toddy palm for production of toddy-shoot and small scale toddy-juice production for self consumption. Production of toddy-juice and processing of jaggery are mainly dependent on toddy workers who came from Central Myanmar. Of the 19 toddy palm owners who owned more than 10 toddy palms, 14 rented their toddy palm to toddy workers on one year basis. It reveals that farmers are not interested on the toddy work since they are busy with farming and are not familiar with it.

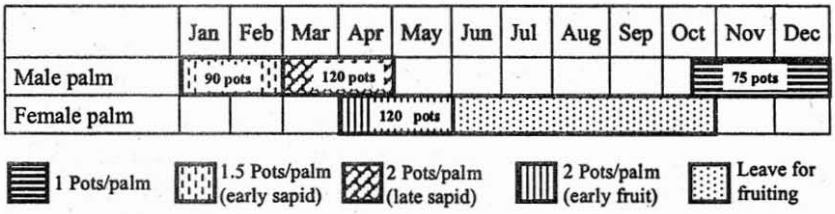
Productivity of Toddy Palm

A toddy palm could produce toddy-juice for jaggery production and alcoholic toddy juice (ATJ) for direct consumption. Female toddy palm could

produce toddy-fruit for direct consumption and matured toddy-seed for the production of toddy-shoot.

Toddy-juice - Production of toddy juice and jaggery could earn a large amount of money. The amount of money could be gained from a toddy palm was calculated based on Figure (3). Toddy-juice from male toddy palm could be tapped during Mid-October and April. The amount of toddy-juice tapped from a toddy palm varied with seasons and skillfulness of toddy worker. The average number of toddy palm that one worker could handle is 50 trees. Of them, toddy-juice could be obtained from 25 toddy palms during Mid-October to December. Average daily tapping amount is about 1 pot (1 pot = 0.63 litter) per toddy palm. Thus, 75 pots of toddy-juice could be collected from a toddy palm during this period.

In January and February, amount of producible toddy palm increased to 50 trees while average amount of toddy juice received from a toddy palm increased to 1.5 pots[1]. Therefore, 90 pots of toddy-juice could be collected in this period.



	Mid_Oct to Dec	Jan and Feb	Mar and Apr	Annual
No. of pot/ toddy palm (A)	75	90	120	
Number of toddy palm producible in specified period (B)	25	50	50	
Total pots (for 50 toddy palms) (A*B) (C)	1875.0	4500	6000	
Average No. of toddy pot/palm (C/50)	37.5	90	120	**247.5**

Figure (3) Calculation procedure of average a mount of toddy juice production

Note: 1 A viss of jaggery (palm sugar) need 5 pots of toddy-juice. Thus a toddy palm could produce 49.5 jaggery on average.

Source: Based on the interviews of toddy workers in Pattan Village.

[1] Toddy-juice is received from early sapid (*Htan-no*) in this period and called as *Htan Po Oo Season*.

In March and April the amount of toddy juice received from one toddy palm (late sapid; *Nyat Htan*) increased to 2 pots. All 50 toddy palms could produce toddy-juice during that period. One hundred and twenty pots could be obtained from a male toddy palm in that period. Total amount of toddy-juice could be collected from a male toddy palm, therefore, is 247.5 pots (refer Fig. 3). From the interviews it is understood that the amount of toddy-juice received from a toddy palm in Taungoo area is relatively higher than the toddy palm grown in Dry Zone Area. Tapping season is longer and earlier in the study area than Dry Zone.

Toddy-juice could be produced from a female toddy palms only during April to October. A female toddy palm could produce more toddy-juice than male toddy palm (U Kyi, et al. 2005). However, toddy palm owners in the study area only allow the production of toddy-juice in April and May from early fruit (*Thi Nu*) because they allow the toddy fruit to germinate into toddy-shoot and sell them, instead of toddy-juice. Although toddy-juice could be produced in April and May no toddy worker tap the juice in the area during that time because it could be tapped only two months with investment which is equal in amount for the whole season.

ATJ and Jaggery - Table (5) shows the average annual cost, income and benefit of a toddy palm in study area. If a toddy worker would make ATJ from toddy-juice of a male toddy palm, one could profit about 35,205 Kyats per year. On the other hand, jaggery production from toddy-juice could only earn 24,805 Kyats per year. ATJ needs one worker while jaggery production demands 2 toddy workers. Although selling in the form of ATJ could gain higher profit and demand less labor, its market is limited. Therefore, many toddy workers produced both ATJ and jaggery.

Table (5) Average annual profit of a male toddy palm in 2006

COST	(Kyats)
Production of toddy-juice	
Pots and ropes (8 pots with rope at 230 Kyat/Unit; could be use for 2 years)	920
Bamboo, timber etc. for ladder	1,000
(hanging and portable ladders)	
Total	1,920

COST	(Kyats)
Jaggery	
1 viss of jaggery need 1.5 bag of paddy husk	
1 bag of paddy husk cost 100 Kyats (for 49.5 viss)	7,425
Other costs (Oven, pan, etc.)	500
Total	7,925
INCOME	(Kyats)
ATJ (Fig. 3)	
Total (one pot of ATJ is 150 Kyats)	37,125
Jaggery (1 viss of jaggery could be obtained from 5 pots of toddy-juice)	
Total (1 viss is 700 Kyats) (49.5 viss * 700 Kyats)	34,650
PROFIT	(Kyats)
ATJ	**35,205**
Jaggery	**24,805**

Source: Based on the interviews of 4 toddy workers.

Note: Labor cost invested by toddy worker is not included in the calculation.

Toddy-shoot production- it is a major toddy product in the study area. From the structured interview it is known that one female toddy palm could bear 250 fruits (200 to 300) after tapping toddy-juice. One toddy fruits could produce 2.5 shoots (2 to 3).The wholesale price of one toddy shoot is 6 Kyats in 2005. Therefore, a farmer could earn 3,750 Kyats (250 fruit* 2.5 shoot* 6 Kyats) of money from one female toddy palm in addition to money gained from producing toddy-juice. Toddy-shoots are mainly produced and sold in November and December. Many farmers are conducting this business from female toddy palms while male toddy palms are rented or left without producing toddy-juice.

At present majority of female toddy palm are used only for toddy-shoot production. If it will be used for toddy-juice or jaggery production the income of farmer would be increased. A female toddy palm could produce 120 pots of toddy-juice before bearing fruits for toddy-shoot. If the wholesale price is 150 Kyats per ATJ it can make amount to 18,000 Kyats. If it is used for jaggery production it could earn 16,800 Kyats (120/5× 700). If female toddy palm is used for toddy-juice and jaggery processing it will cost 1,920 Kyats and 3,720 Kyats (1920+ 2300+ 500), respectively. Thus, the possible net profit from ATJ and jaggery is 16,080 (18,000-1,920) Kyats and 13,080 Kyats (16,800-3,720) (Table 6). In addition it could earn 3750 Kyats from toddy-shoots.

Table (6) Annual profits could gain from a toddy palm in Pattan Village

	Profit (Kyat)		
	Toddy-juice	Jaggery	Toddy-shoot
Male palm	35,205	(or) 24,805	+ 0 Kyats
Female palm	16,080	(or) 13,080*	+ 3,750 Kyats

Note: * Calculated based on income (24 Viss of jaggery * 700 Kyats); cost (1,920 Kyats for toddy-juice + 3,000 Kyats for fuel + 500 Kyat for general cost) (Ref: table 5)

Toddy Worker- A toddy worker could collect toddy-juice from 50 male toddy palms in one day. A cost for rental of a toddy palm is 500 Kyats. Therefore, he could earn 144,604 Kyats ((35,205-500) × 50÷ 12)) a month from ATJ. If he is engaged in jaggery production due to lack of ATJ market, he need two workers (probably his wife or san) and a worker could earn 50,635 Kyats ((24805-500) × 50÷ 12÷ 2)) a month. It is clear that toddy worker could earn a large amount of money by marketing of ATJ. Although the incomes are calculated for the whole year toddy worker do not need to work from May to Mid-October[1], so he could have extra money from working in other jobs.

There are four toddy workers in Pattan Village in 2006. Two of them moved into the village since last 4 years and lived permanently in the village. Other two workers are seasonal toddy workers and they are also engage in toddy works in Nwahtogyi Township. Since tapping-season in the study area

[1] It is in case of male toddy palm.

is relatively earlier than Dry Zone they tap toddy-juice during October to February in study area on half-by-half basis and moved back to Nwathogyi to be engaged in their own toddy work. Therefore, with these four toddy workers the whole toddy palm works could not be tapped to its full capacity.

From the perception of local people, it is understand that they do not fully realize the economic value of toddy palm and do not want to be engaged with toddy work. The interview results of the villagers about the reasons for not engaging themselves in toddy works revealed that majority of them (73%) are not familiar with toddy works (they are afraid to climb the toddy palm and not skillful in this job). Some people (20%) mentioned that they are not interested in the toddy works. The rest (7%) mentioned that toddy is not their major economy.

Toddy Palms: An Alternative Rural Economy?

To understand the contribution of toddy palm to the economic conditions of rural people, interviewees are requested to answer the time of economic and social crisis during their life in Pattan Village and the role of toddy palm during that crisis situation.

Among the 17 interviewed farmers, 13 faced with crop failures due to climatic condition during their experience. Of them, 9 cases are due to late onset of monsoon and irregular rain in the early rainy season, 3 cases are due to flood occurrences during the rainy season and one case is due to disturbance from insects. Of the 13 farmers facing with crop failure for paddy and peas, 7 answered that income derived from toddy palm provided them to recover their household's economy to the certain extent. Paddy and peas could be affected by minor climate changes. Toddy palms, however, could withstand minor climate change. Thus, while farmers are facing with crop failure, income from toddy palm could support the farmer's family.

Five farmers were faced with social difficulties in the past (health, children living cost, etc.) in the study area. Of them, 3 farmers answered that during those difficulty periods toddy palm supported them to certain extent. Toddy palm could be sold to other farmer in case of economic difficulties. Therefore, it could be considered that toddy palms are facilitating to recover from economic difficulties in the study area.

As proved in the previous section a male toddy palm could make 35,205 Kyats (from ATJ) or 24,805 Kyats (jaggery) of profit in one year. Therefore, the value of toddy palm is higher than what the villagers understood. The values, however, are underestimated with the lack of fully exploitation of its products. Farmers in the study areas generally rented their male toddy palm for 500 Kyats per tree. In case of female toddy palm they only collect the fruit and made toddy-shoot. Therefore, if full capacity of toddy palm was exploited it could be an alternative economy of the region and the income derived from the toddy palm could contribute in the investment of paddy cultivation.

Possible contribution of toddy palm to the rural economy could be examined from the two case studies. Table (7) shows the possible profit from the full extraction of existing toddy palm. Case 1 could gain 894,015 Kyats if all toddy-juice are sold out as ATJ or 228,815 Kyats if jaggery production from 33 matured toddy palms. In addition, he could profit 52,500 Kyats from toddy-shoots. Therefore, the total income from toddy palm is 946,515 Kyat (or) 281,315 Kyats for Case 1 farmer. The farmer of case 2 who has 25 mature toddy palms could profit 680,250 Kyats (if ATJ) or 203,650 Kyats in case of making jaggery.

Table (7) Profit from the full capacity extraction of existing toddy palm

	Producible toddy palm			Profit (Kyat)			
	Total	Male	Female	If ATJ	If Jaggery	Toddy-shoot	Total
Case 1	33	19	14	894,015	228,815	52,500	946,515 (or) 281,315
Case 2	25	12	13	631,500	198,900	48,750	680,250 (or) 203,650

Source: Calculated based on Table 6.

To understand the role of toddy palm in the total income of two case studies, it is compared with income gained from paddy and peas (Table 8). Since case 1 farmer owned 2.01 acres of land he could profit 362,059 Kyats

from cultivation of paddy and peas on his farm. If he fully utilized the toddy palms grown on the embankment of his farm land, he could earn 946,515 Kyats (ATJ+ Toddy-shoot) or 281,315 Kyats (jaggery). In terms of percentage contribution of toddy palm for the total income, therefore, it is 72% or 43%. If similar calculation is considered for Case 2 farmer who owned 1.98 acres of farm land, toddy palm could contribute 66% or 36% of total income.

From the above two case studies it is understood that the income of rural people would be increased from 2 to 3 times if the present toddy palms are utilized to its full capacity.

Table (8) Contribution of toddy palm in household in come of two case studies

	Profit from toddy*		Profit from paddy and peas**				Toddy % in total income
	If ATJ + Toddy-shoot	If Jaggery+ Toddy-shoot	Area	Paddy	Peas	If both	
Case 1	946,515	281,315	2.01	149,178	212,881	362,059	72 % (or) 43%
Case 2	680,250	203,650	1.98	146,952	209,704	356,655	66% (or) 36%

Source: Note: * Calculated based on table (7); ** Calculated based on table (3)

There are 943 matured toddy palms in Pattan Village. The amount of profits that would be gained for full extraction of present toddy palm was calculated and shown on Table (9). If all toddy-juice produced from 943 toddy palms are sold out as ATJ, it could earn 26,986,815 Kyats (including income of toddy-shoot from female palm). If all toddy-juice are used for production of jaggery and toddy-shoot it could still gain 20,169,215 Kyats.

Table (9) Contribution of present toddy palm to the village economy

	No. of toddy palm	Profit (Kyats)	
		ATJ+ Toddy-shoot	Jeggary+ Toddy-shoot
Male	539	18,975,495	13,369,895
Female	404	8,011,320	6,799,320
Total	943	26,986,815	20,169,215

Note: Calculated based on average profit of a toddy palm (Table 6)

ATJ refers to alcoholic toddy juice.

Therefore, if toddy palms are fully exploited it will play a very important role in the economy of study area. Toddy palm is far more valuable than the buffer crop that facilitates to recover from economic difficulties and it could be considered as an alternative economy of study area.

Conclusions and Discussion

With the changing economic system and development of infrastructures, agriculture activities are expanded and/or intensified. Based on the situation that toddy palms are in danger of being wipe out for various reasons, the comparative analysis between farm crops and toddy palm was carried out in this paper.

Findings

The analysis results show the following points:

(1) There is no significant evidence that toddy palms could have an effect on the production of paddy from the present distribution pattern (Eq. 1&2 and Eq. 3&4).

(2) The farmland area lost by the presence of toddy palms is less than 2 percent (Fig. 2).

(3) Comparative economic cost and benefit analysis results revealed that it is more profitable to keep toddy palm in the present state instead of growing

paddy and peas in the same area (Table 4).

(4) Real values of the toddy palms are not fully recognized by the local people since primary economy is cultivation of paddy and the farmers could survives on it and the potential of toddy palms are not fully exploited.

(5) A male toddy palm could profit about 35,205 Kyats annually if toddy-juice is sold out as alcoholic toddy juice (ATJ). If toddy-juice used for jaggery production it could only earn 24,805 Kyats annually. The annual profit of a female toddy palm from ATJ is 16,080 Kyats or 13,080 Kyats from jaggery (Table 6). In addition, it could earn 3,750 Kyats from toddy-shoots.

(6) A toddy worker could earn monthly 144;604 Kyats from ATJ or 50,635 Kyats from jaggery.

(7) Although toddy palm is profitable, local people do not want to be engaged in toddy work because they are not familiar with it (they afraid to climb the toddy palm and not skill in this job).

(8) Toddy palm is much more beneficial than the buffer crop that facilitates rural people to recover from economic difficulties and could be considered as an alternative economy of study area (Table 8 & 9).

Discussion

Toddy palm and rural development- At present, 87.48 percent of the toddy palms are under production for toddy juice and/or toddy-shoot. If farmers could produce toddy-juices from all toddy palms, the income of rural people will be tremendously increased. From the interviews, it is found that farmers have to sell out majority of the paddy and peas just after harvesting to pay their debt and/or for investment on next crop. Actually they have to sell their paddy at low price and have to buy at high price for their consumptions. This problem could be solved if they earn more money from toddy palm. If farmer earn more money from toddy palm they could invest more money on the paddy cultivation. As a consequence paddy cultivation in the area will be further promoted. Thus, full utilization of existing toddy palm could lead to rural economic development and subsequent economic development of the country.

New Technology to preserve toddy-juice- Second point is related to the variation of income from toddy palm. Income generated from ATJ is more

than double that of jaggery and need only few investments. However, the market is limited and toddy workers have to conduct both ATJ and jaggery. Therefore, new market should be created by inventing new preservation techniques.

The total yield of jaggery from a toddy palm is relatively higher in Taungoo than Dry Zone due to its longer and earlier tapping season. A viss of jaggery could be obtained from 4 pots of toddy-juice in Dry Zone Area while it needs 5 pots of toddy-juice in Taungoo area to get the same amount of jaggery due to its location in a relatively moist area. In fact, Taungoo area could produce more toddy-juice than Dry Zone even if the production of jaggery is the same. Therefore, it is more profitable for Taungoo to sell toddy-juice in juice form (ATJ). Many toddy workers send ATJ to Taungoo and nearby villages daily.

Other minor economic activities- Systematic and full scale production of toddy-juice and jaggery processing could lead toddy palm to become an alternative economy of farmer and one of the main source for rural income generation activities. Other toddy products like baskets and household utensils are also produced in one household in the study area by a toddy worker family. This activity could be considered as an additional household income generation activities workable by the family members. As U Kyi, et al. (2005) and Botanist (Myat Thi Tar, 2006; Than Than Mar, 2005) have mentioned, all parts of toddy palm are useful for human beings. Since other toddy products (rather than ATJ and jaggery) are not yet introduced and Taungoo is far away from the toddy products of Dry Zone, production of new toddy products should have a large market.

Toddy and environmental problems – Environmental problems could occur with the economic development. Therefore, we should consider economic development together with possible environmental problems. U Kyi, et al. (2005) and Tin Aye and Khin Maung Zaw (2006) pointed out that jaggery production need a large amount of fuel woods that could lead to the forest depletion. In the study area, however, jaggery production was currently made by ovens that used paddy husks and toddy leaves. Therefore it is not necessary to be worried about fuel and environmental problem in study area. In addition, since toddy palms are located in the paddy fields rather than as separate toddy fields it is maintaining both ecological and economic balances.

In general, this paper pointed out that there are chances to find the ways of development on the existing resource and economic potentials of

rural areas instead of searching investment from outside area. In case of toddy palm it is not necessary to make new investment, or it is not necessary to change land use policy. By means of changing perceptions of local people and the way of utilization on existing resources the economic conditions of farmer could be improved and farmer could pay more attention on the main economy of paddy cultivation. Therefore, it could be considered that this paper open up a new way of rural development studies which is deviating from the traditional concluded methods used with outside assistance for development plans.

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