

Analysis on Volume of Crop Land Change in Irrigated Sown Acreage Within Myingyan District

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Abstract

The main objective of the study is to investigate volume of crop Land change in irrigated sown acreage with irrigation and impact of irrigation on agricultural development in Myingyan District. Based on physical factors and socio-economic factors, types of irrigation in Myingyan District vary from place to place. Paddy cultivation is a compulsory planned crop in the irrigated areas of government-owned dams and river water pumping irrigated areas. Other cash crops, such as onion, wheat, sesame, chilli, etc, can be freely cultivated in irrigated areas free to select by surface wells and tube wells irrigation and other means of irrigation. In the study, volume of crop land change is analyzed by Crop Sequence Method for the years 1999-2000 and 2008-2009. Properties of sample farmers in sample village tracts for 2009-2010 are increased by 3.92 times in Tharbaung Village Tract of Tharbaung River Water Pumping Irrigated area and 2.48 times in Tawpu Village Tracts of No.2 Extension Sameikkon River Water Pumping Irrigated area, according to the result of Property Index Method. It reveals that the agricultural and socio-economic activities have been developing in irrigated areas of Myingyan District.

Key words: irrigation, Crop Sequence Method, Property Index Method.

Introduction

Myingyan District lies in the Dry Zone of Central Myanmar. An annual rainfall is less than 40 inches or 1,000 mm and its annual rate of potential evapo-transpiration (PET) is usually greater than annual rainfall. It usually experiences the unsuccessful maturity and ruin of crop, followed by inconvenient economy of majority of farmers under unreasonable climatic conditions. In order to solve this problem, irrigation cultivation has been made from hand-dug wells and ponds.

After 1988, with the development of market economy prices of crops have risen up more than ever. Accordingly dams and reservoirs irrigation and river water pumping irrigation works have been being constructed and thus cultivated acreages of planned crops and cash crops have also expanded by wells and tube wells irrigation in Myingyan District.

In accordance with changes of irrigated acreage, cultivated crop patterns, soil types and socio-economic conditions could have also been changed over time.

Research Problems

The main aim in this paper emphasized on the volume of crop land change in irrigated sown acreage within Myingyan District. As the volume of crop lands are changed, the agricultural and socio-economic developments are found in there.

1. How are the volume of crop lands changed within Myingyan District?

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2. Which impacts are found by volume of crop land change in irrigated areas?

Study Area

Study area is Myingyan District, located in the Dry Zone of Central Myanmar. It is situated between North Latitudes 20° 32' 30" and 21° 47' 10.26" and East Longitudes 94° 50' and 95° 29' 32". Ayeyarwady River flows along the northern and western boundary of Myingyan District and most of the streams in Myingyan District are seasonal and some are perennial. It comprises 5 townships, namely, Myingyan, Taungtha, Natogyi, Kyaukpadaung and Ngazun Township. The total area is about 2477.04 square miles. The total sown acreage is 937,636 acres and among them 46,183 acres is irrigated in 1999-2000. In 2008-2009, the total sown acreage is 981,678 acres and the irrigated acreage is 76,764 acres.

Materials and Methods

This study is based on analysis of primary data gathered from field observations, interviews, questionnaires and informal talks. Secondary data is based on data bases from Meteorology and Hydrology Department, General Administration Department, Land Records Department, Agriculture and Irrigation Department, Water Resource Utilization Department in Myingyan District and Mandalay, and reference books and records. These data bases are analyzed by using Crop Consequence Analysis Method and Property Index Method.

Changes of Sown Acreage by Types of Irrigation

In Myingyan District the irrigated acres totaled 46,183 acres or 4.96% of the district total sown acreage (937,636) acres in 1999-2000 and 76,764 acres or 7.82% of the district total sown acreage (981,678) in 2008-2009. Thus the irrigated acres have increased by 30,581 acres as an effect of irrigation from the new dams, from the Ayeyarwady River Water Pumping, and extended growing of cash crops by mean of surface wells and tube wells irrigation. The changes of sown acreages between 1999-2000 and 2008-2009 are described in Table (1) and Figure (1) and (2).

Table (1) Irrigated sown acreage and changes by types of irrigation in Myingyan District between 1999-2000 and 2008-2009

Sr	Types of irrigation	Irrigated acreage		Changes
		1999-2000	2008-2009	
1	Dam, reservoir, lake and Pond irrigation	10,326 (21.46%)	21,731 (28.3%)	+11,405
2	River water pumping irrigation	3,293 (6.84%)	6,088 (7.9%)	+2,795
3	Surface wells and tube wells irrigation	20,320 (42.21%)	32,520 (42.4%)	+12,200
4	Other means of irrigation	14,202 (29.50%)	16,425 (21.4%)	+2,223
	Total	48,141	76,764	+28,623

Source: Land Records Department and Irrigation Department in Myingyan District, 2009.

According to the Table (1), in 1999-2000 the largest irrigated sown acreage was under the surface wells and tube wells irrigation, the second largest irrigated sown acreage under the other means of irrigation, and the third largest irrigated sown acreage under the irrigation of dam, reservoir, lake, and pond. On the contrary, the smallest irrigated sown acreage was under the river water pumping irrigation. In 2008-2009, except the change of irrigation by dam, reservoir, lake and pond which stood into the second largest irrigated sown acreage, other means were no change in rank.

In order to develop the agricultural sector of Myingyan District, the government has constructed various irrigation works within the district and makes farmers to grow paddy and cotton. Moreover cultivation by private irrigation has also been allowed to the local farmers. Before 1995-1996, government-owned dam and, reservoirs accounted for 10 and river water pumping amounted to 3 stations. Among them, reservoirs amounted to 6. However, prevailing scanty rain resulted in a small amount of surface run-off flowing into the dams and the reservoirs. Besides, lack of maintenance in irrigation canals and system, and insufficient supply of diesel and

electricity for river water pumping irrigation could not achieve successful production of crops as the target already planned.

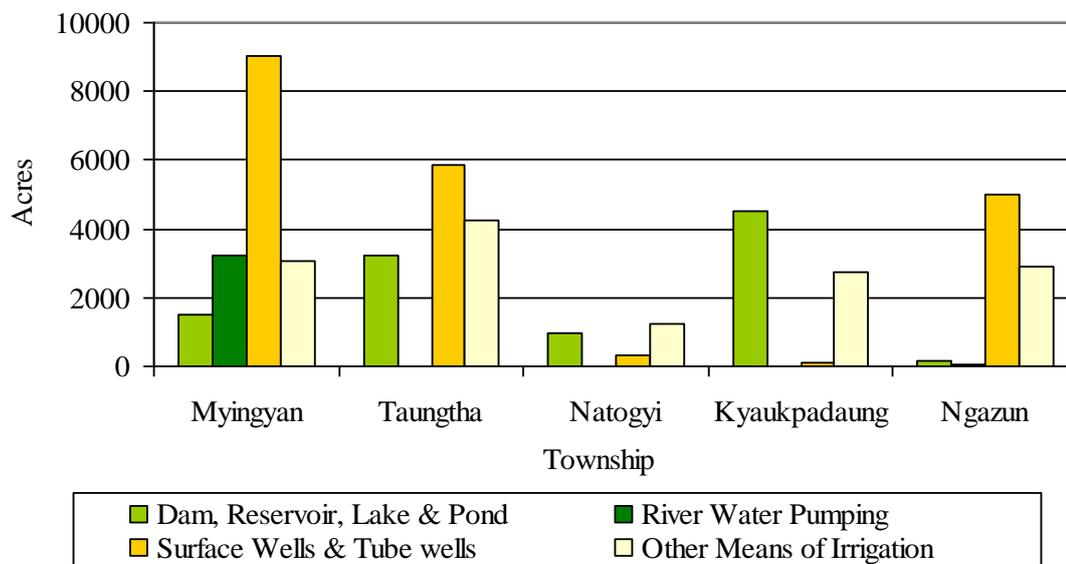


Figure (1) Township wise Irrigated Acres by Types of Irrigation in Myingyan District (1999-2000)

Source: Land Records Department in Myingyan District.

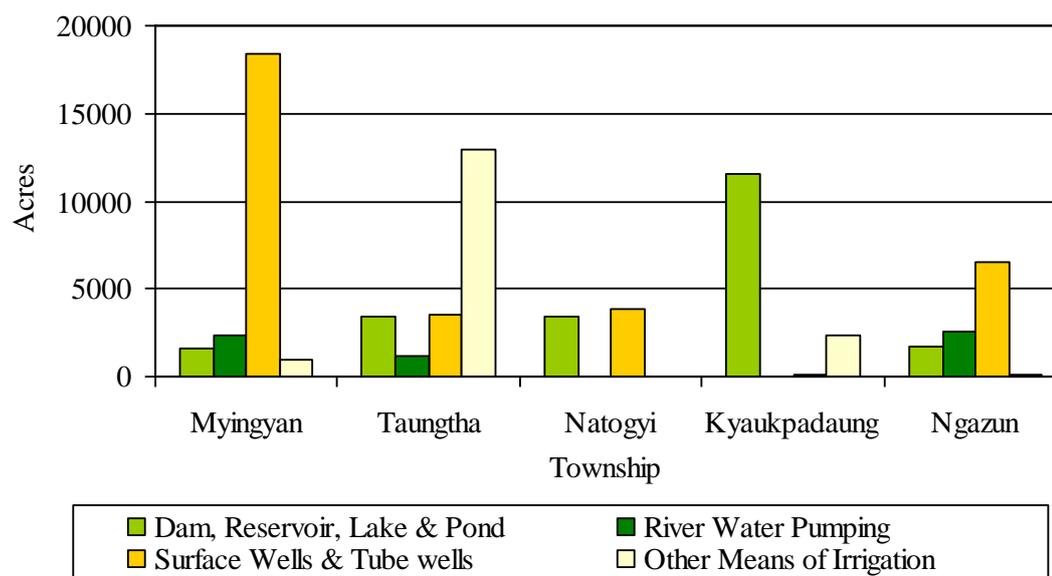


Figure (2) Township wise Irrigated Acres by Types of Irrigation in Myingyan District (2008-2009)

Source: Land Records Department in Myingyan District.

Relief and topography of the district usually formed of lowland plains help the local farmers grow crops with supply of underground water and of surface wells and tube wells irrigation. Moreover rising price of crops also encouraged the farmers to grow cash crops intensively, by irrigation from hand-dug wells and tube wells and by carrying water with tins on shoulders. As a result there was a totaled 20,320 irrigated sown acreages before 1999-2000. After 1999-2000, in accordance with using small private-owned water pumps in place of manual carrying, irrigated sown acreage of the district has also increased to 32,520 acres in 2008-2009 and this type of irrigation stand at first rank among the acreages irrigated by various means. The second rank and the third rank are under the irrigation from dams, reservoirs, lakes, and ponds, and other means of irrigation respectively.

Regarding river water pumping irrigation from the Ayeyarwady River there were four river water pumping stations namely Kyauktalon, No.1 Sameikkon, No.2 Sameikkon, and Tharbaung. These four stations could irrigate 3,293 acres in 1999-2000. In 2008-2009 the irrigated acreage had increased by 2,795 acres under the extended river water pumping programs. However this irrigation type supports only the least irrigated acreage among all irrigation methods.

Analysis on Volume of Change in Irrigated Sown Acreage by Crop Sequence Method of J.Singh and S.S.Dhillon

Volume of change in crops refers to change of growing crops between the two designated years (J.Singh and S.S.Dhillon, 2004). In calculation two variables such as irrigated sown acreage of individual crops and the total irrigated sown acreage of each township are used. Calculated results are described in Tables (2 to 4).

The calculated figures indicate that volume of change in irrigated sown acreage during 2008-2009 over 1999-2000 was +/- 18.94 in Myingyan District. The result implies that major shift of crop occurred from onion to paddy between the two years and second major shift from long staple cotton to maize, whereas the least change was found from onion to wheat and the second least change from long staple cotton to chilli and fodder.

In Myingyan Township, the volume of change in irrigated sown acreage was +/- 27.89. Major shift of crop was from long staple cotton to maize and the second major shift from onion to paddy while the least shift was from long staple cotton to tobacco and the least shift from onion to wheat.

In Taungtha Township, the volume of crop change is within +/- 22.17. Of these the major shift was onion to paddy and second major shift was long staple cotton to paddy. The lowest shift was paddy to fodder in this township.

In Natogyi Township, volume of crop change fell within the range of +/-21.08. Major shift was from onion to paddy and the second major shift was from onion to other cereal crops.

In Kyaukpadaung Township, the volume of change in irrigated sown acreage was +/-6.56. Between the two years major shift was from onion to paddy and the second major shift from long staple cotton to sesame whereas the least shift occurred from onion to sesame.

In Ngazun Township, volume of crop change was within the range of +/- 16.37. Major shift was from onion to sesame and paddy while the least shift was from onion to other cereal crops.

Therefore among the townships of Myingyan District, the township with the highest volume of change in irrigated sown acreage was Myingyan Township with +/- 27.89, and the lowest change in Kyaukpadaung Township within +/- 6.56. Generally high volume of change (those higher than 20) between the years 1999-2000 and 2008-2009 occurred in Myingyan Township, Taungtha Township, and Natogyi Township, the moderate volume of crop change in Ngazun Township and the low level in volume of crop change in Kyaukpadaung Township.

The major shift areas are mostly found in the government irrigated project areas. Paddy is the dominant and major shift crop in the government irrigated project area. The volume of crop land change is described to analyze the agricultural development and socio economic development. In comparison of benefits for the volume of crop land change obtained from irrigation means, it varies from one type of irrigation to another. These variations are examined by two case studies based on River Pumping irrigated areas.

Table (2) Volume of change in cropland of Myingyan District and Myingyan Township (1999-2000 and 2008-2009)

Myingyan District

No	Crops	Percentage of Irrigated Crop Area		Change in Percent
		1999-2000	2008-2009	
1	Paddy	35.67	48.04	12.37
2	Onion	36.61	27.42	-9.19
3	Sesame	10.97	10.82	-0.15
4	Maize	0.53	5.3	4.77
5	Wheat	1.67	1.99	0.32
6	Chilli	0,81	1.55	0.74
7	Fodder	0.53	1.27	0.74
8	Other Cereals	2.11	1.1	-1.01
9	Vegetable	1	0.79	-0.21
10	Long staple cotton	7.82	0.75	-7.07
11	Tobacco	1.04	0.71	-0.33
12	Garlic	1.23	0.27	-0.96
13	Banana	0.02	0.01	-0.01
Total		100	100	+/- 18.94

Myingyan Township

No	Crops	Percentage of Irrigated Crop Area		Change in Percent
		1999-2000	2008-2009	
1	Paddy	15.95	23.63	7.68
2	Onion	47.61	39.38	-8.23
3	Sesame	15.57	16.51	0.94
4	Maize	-	18.1	18.1
5	Wheat	0.78	1.72	0.94
6	Chilli	0.29	-	-
7	Fodder	-	-	-
8	Other Cereals	-	-	-0.29
9	Vegetable	-	-	-
10	Long staple cotton	17.98	0.44	-17.54
11	Tobacco	-	0.23	0.23
12	Garlic	1.82	-	-1.82
13	Banana	-	-	-
Total		100	100	+/-27.89

Table (3) Volume of change in cropland of Taungtha Township and Natogyi Township (1999-2000 and 2008-2009)

Taungtha Township

No	Crops	Percentage of Irrigated Crop Area		Change in Percent
		1999-2000	2008-2009	
1	Paddy	17.09	36.58	19.49
2	Onion	48.32	38.86	-9.46
3	Sesame	11.09	7.7	-3.39
4	Maize	1.71	1.42	-0.29
5	Wheat	2.85	2.81	-0.04
6	Chilli	1.81	1.49	-0.32
7	Fodder	1.7	4.38	2.68
8	Other Cereals	6.28	3.53	-2.75
9	Vegetable	3.23	2.47	-0.76
10	Long staple cotton	5.17	0.27	-4.9
11	Tobacco	0.32	0.1	-0.22
12	Garlic	0.43	0.39	-0.04
13	Banana	-	-	-
Total		100	100	+/- 22.17

Natogyi Township

No	Crops	Percentage of Irrigated Crop Area		Change in Percent
		1999-2000	2008-2009	
1	Paddy	36.92	48.32	11.4
2	Onion	50.7	38.03	-12.67
3	Sesame	3.51	0.68	-2.83
4	Maize	-	-	-
5	Wheat	-	-	-
6	Chilli	-	9.03	9.03
7	Fodder	-	-	-
8	Other Cereals	-	0.65	0.65
9	Vegetable	-	-	-
10	Long staple cotton	8.87	3.28	-5.59
11	Tobacco	-	-	-
12	Garlic	-	-	-
13	Banana	-	-	-
Total		100	100	+/- 21.08

Table (4) Volume of change in cropland of Kyaukpadaung Township and Ngazun Township (1999-2000 and 2008-2009)

Kyaukpadaung Township

No	Crops	Percentage of Irrigated Crop Area		Change in Percent
		1999-2000	2008-2009	
1	Paddy	88.07	91.86	3.79
2	Onion	8.32	3.66	-4.66
3	Sesame	1.08	3.85	2.77
4	Maize	-	-	-
5	Wheat	-	-	-
6	Chilli	-	-	-
7	Fodder	-	-	-
8	Other Cereals	0.37	0.31	-0.06
9	Vegetable	-	-	-
10	Long staple cotton	1.69	0.2	-1.49
11	Tobacco	0.35	0.13	-0.22
12	Garlic	0.13	-	-0.13
13	Banana	-	-	-
Total		100	100	+/- 6.56

Ngazun Township

No	Crops	Percentage of Irrigated Crop Area		Change in Percent
		1999-2000	2008-2009	
1	Paddy	43.66	49.63	5.97
2	Onion	22.49	10.79	-11.7
3	Sesame	17.74	24.21	6.47
4	Maize	-	-	-
5	Wheat	4.01	5.34	1.33
6	Chilli	1.82	2.56	0.74
7	Fodder	-	-	-
8	Other Cereals	-	0.14	0.14
9	Vegetable	-	-	-
10	Long staple cotton	-	1.71	1.71
11	Tobacco	6.32	4.38	-1.94
12	Garlic	-	-	-
13	Banana	0.16	0.04	-0.12
Total		100	100	+/- 16.37

Source: Land Records Department, Myingyan District, 2008-2009.

Case study on Impact of Volume of Crop Land Change in Irrigated Sown Acreage Within Myingyan District

A case study 1 is Tharbaung River Pumping irrigated area in which Tharbaung Village Tract was selected.

Tharbaung Village Tract is located in Tharbaung River Pumping irrigated area. This village is one of the three village tracts in Tharbaung River Pumping irrigated area. This is also situated on the left bank of Sekan Inn, a flooded area of Ayeyarwady River. Over 70 households are cultivated by the river pumping irrigation in 2008-2009. Tharbaung irrigation project was started in 1996-1997. During the studied years the crop in the irrigated area was changed from tobacco, pulses and other crops to paddy.

In order to know the benefit obtained from the irrigation agriculture, as sampling 34 irrigating farmers of Tharbaung Village Tract in Tharbaung River pumping Irrigated area, were interviewed under field observation. Under river pumping irrigation there are 9 paddy growing farmers, 16 farmers grow both paddy and gram as double cropping, and 9 paddy farmers who grow sesame as second crop after paddy. Those who use surface wells and tube wells irrigation also grow summer sesame only. Prior to 1996-1997, tobacco was mainly cultivated in Tharbaung irrigated area, but paddy is being cropped there. In the remaining non-irrigated area, tobacco, gram and fodder are mainly cropped. According to the interview results on return profit from growing of paddy (the government's planning crop) and tobacco (non-planning crop) are described as follows.

The net profit of yield per acre of tobacco was 176,000 kyats. The net profit of yield per acre of irrigated paddy was 210,000 kyats. So, the net profit was exceeded, 34,000 kyats and sufficiently given the food for cattles by irrigated paddy cultivation than the tobacco cultivation. In Tharbaung River pumping irrigated area, the profit of growing sesame and the profit of gram after paddy cultivation may be mentioned again. So the net profit gained 113,000 Kyats in growing of sesame after paddy.

The net profit for growing gram was 83,400 Kyats. So the total income was gained 323,000 Kyats by growing of paddy and sesame or 293,400 Kyats by growing of paddy and gram. Thus paddy and sesame growing was the most profited crop in Tharbaung River pumping irrigated area.

Besides, properties of the sample farmers are compared in Table (5) in Tharbaung Village Tract for two periods (before 1996-1997 and 2009-2010).

Table (5) Comparison of properties of sample farmers in Tharbaung River Pumping Irrigated Area.

No	Name of Property	Number of Property	
		Before irrigation (1996-1997)	Current (2009-2010)
1.	Bicycle	30	33
2.	Cycle	-	31
3.	Radio	7	14
4.	Trawlargyi	-	1
5.	Water Pump	2	23
6.	T V	-	24
7.	Video	-	24
8.	Phone	-	3
	Total	39	153

Source: Based on Field Observation, 2009-2010.

Based on the above mentioned data, by using the property indices formula, $P.I = \frac{A_1 + A_2 + \dots + A_n}{S} \times 100$ property indices (P.I) are calculated for the two years. In the formula, A_1, A_2 and A_n refer to each type of properties such as bicycle, cycle, tractor, etc, whereas 'n' refers to number of property type and 'S' refers to sample farmer population. According to the result, P.I was 114.7 for the year 1996-1997 (before irrigation) and 450 for 2009-2010 (current) in Tharbaung River Pumping irrigated area. The P.I indices indicated that the number of properties of the irrigated farmers

in 2009-2010 had increased 3.92 times that of before 1996-1997 in the Tharbaung irrigated area.

Apart from the above mentioned facilities, building types of the farmers have also changed as shown below.

Table (6) Changes in Building Types of Sampling Irrigation Farmers in Tharbaung Village Tract (1996-1997 and 2009-2010).

Types of Building	Before Irrigation (1996-1997)		Current (2009-2010)	
	One-Story	Two-Story	One-Story	Two-Story
Bamboo	12	2	6	6
Bamboo + Brick	3	3	5	5
Brick	2	10	2	10

Source: Based on Field Observation., 2010.

A case study 2 is No.2 Extension Sameikkon River pumping irrigated area in which Tawpu Village Tract was selected. Tawpu Village Tract is located in the No.2 extension Sameikkon River pumping irrigated area. It is the largest one among five village tracts in this irrigated area. There are 634 households in the village tract and (116) farmers are engaged in river pumping in 2008-2009. Irrigation started in 2003-2004. Before river pumping irrigation, onion, chilli, wheat and gram were mainly cultivated by surface wells and tube wells irrigation. After starting of river pumping irrigation, paddy is the dominant major shift crop in this river pumping irrigated area.

In order to know the benefit of crops obtained from different means of irrigation, 60 river pumping irrigating farmers in Tawpu Village Tract were interviewed under field observation. All farmers cultivate paddy in less than 5 acres of farm land by river pumping irrigation, and in the other irrigated areas, onion, wheat and chilli are cultivated by using surface wells and tube wells irrigation. The farmers who are engaged in river pumping irrigation in less than 3 acres are 70% and the others who are engaged in river pumping irrigation in between 3 and 5 acres are 30%.

According to the observation, the net profit of onion cultivation was exceeded 1,707,000 Kyats in 2008-2009 than paddy, the changed crop. Price of onion was changed yearly, and it was low level in 2009-2010. But the net profit of one acre on onion 2009-2010 was exceeded 57,000 Kyats than paddy. The net profit of wheat cultivation was exceeded 29,000 Kyats and chilli cultivation was exceeded 58,000 Kyats than that of paddy cultivation. Paddy was grown as double crop by river pumping in this irrigated area. But onion, wheat and chilli were grown by surface wells and tube wells irrigation. Most of the farmers cultivated sesame, fodder crops, etc, as double crops by using wells and tube wells after onion, wheat and chilly crops are harvested. Cultivated acres on onion, wheat and chilli crops were higher than acres on paddy in Tawpu Village Tract. Therefore, the income of people in this village tract would be increased and socio-economy would be developed. Besides, properties of the sample farmers are compared for two periods 2003 and 2009-2010.

Table (7) Comparison of properties of farmers in Tawpu Village Tract in No.2 Extension Sameikkon River pumping irrigated area.

No	Name of Property	Number of Property	
		Before irrigation (2003)	Current (2009-2010)
1.	Bicycle	52	27
2.	Cycle	1	52
3.	Radio	33	43
4.	Trawlargyi	-	1
5.	Water Pump	6	47
6.	T V	-	24
7.	Video	-	24
8.	Phone	-	3
9.	Truck	-	1
10.	Thresher	-	1
11.	Oil mill	-	1
12.	Tractor	1	6
13.	Loudspeaker	-	1
	Total	93	231

Source: Based on Field Observation, 2009-2010.

According to the Table (7), by using the property index (P.I) formula, P.I of the year 2003 was 155 and for 2009-2010 were 385. So, the number of properties of the irrigated farmers in Tawpu Village Tract in 2009-2010 had increased 2.48 times than that of before 2003.

Apart from the above mentioned facilities, building types of the farmers have also changed as shown below.

Table (8) Changes in Building Types of Sampling Irrigation Farmers in Tawpu Village Tract (2003 and 2009-2010).

Types of Building	Before Irrigation (2003)		Current (2009-2010)	
	One-Story	Two-Story	One-Story	Two-Story
Bamboo	41	15	5	35
Bamboo + Brick	-	1	-	2
Brick	1	2	11	7

Source: Based on Field Observation, 2009-2010.

According to the above described tables, study areas were developed not only in types of building but also other social factors. Therefore, agricultural and socio-economic developments of irrigated areas in Myingyan District were found by field observation through case study areas.

Conclusion

As Myingyan District receives low rainfall and high temperature, government emphasizes extension of agriculture and the availability of agricultural water. Private irrigation works are carried out by raising price of crops. Thus irrigated farming is well developed in Myingyan District. Among the irrigation means, surface wells and tube wells irrigation provide more profit, as a result of getting change in choice of crops to be grown. The two case studies show that irrigation agriculture improves the local socio- economic conditions. Properties owned by farmers of the irrigated agriculture have increased by 3.92 times in Tharbaung and 2.48 times in Tawpu village tracts in the year 2009-2010 and before the commence of irrigation. Apart from the above mentioned, in the irrigated areas under the government planning, growing of other cash crops or farmer's desired crops within Myanmar's export crops should be allowed as the second crop after harvesting of the planned paddy crop and should be supplied with irrigation water adequately

Acknowledgements

I would like to express my thanks Dr Ko Ko Myint, Principal, Myingyan Degree College for providing the full facilities and support of this research. I also would like to thank. Dr Me Me Soe, Head and Professor, Department of Geography, who advises and encourages of this research work. I am deeply indebted to my Supervisor, Dr Saw Pyone Naing, Pro Rector, University of Mandalay with special thanks for giving good advices, reading and guiding in my dissertation work.

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