

A GEOGRAPHICAL ANALYSIS ON THE EFFECTS OF DAMS ON IRRIGATED AREAS IN DAIK-U TOWNSHIP

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Abstracts

Myanmar is predominantly agricultural- based and paddy being the staple food of the country, is grown both under rain fed and irrigation conditions. Pinyinon ,Bawni ,Kawliya and Bindar dams and its irrigated area are distributed in Daik-U Township providing summer paddy. The aims of this paper are to present the summer paddy cultivation conditions and soil fertilizer decreasing and other effects on summer paddy land of the study area. The average sown area of summer paddy was 4481 hectares in the study area within 10 year period from 2007-08 to 2017-18 that irrigated by the above mentioned four dams. SWOT analysis method is used to know the details of positive and negative impacts of irrigated area. Based on 242 responds in 22 village tracts of summer paddy cultivation, the positive and negative effects of dams irrigated area can be found in study area. These effects irregularly distribute within each dam and irrigated area. Although Bindar dam and its irrigated area is the largest size among all dams, negative impact on soil salinity and alkaline, waterlogging of this dam is very low. But, the use of fertilizers and pesticides are a little more than other dams. Positive effect of Bindar dams as increasing summer paddy cultivated area and food production is higher than other dams. After finding the negative and positive effect of these four dams, the solutions for these effects are sought out.

Key Terms; dam, irrigated area, SWOT analysis, positive and negative effects

Introduction

Myanmar is predominantly agricultural- based and paddy being the staple food of the country is grown both under rain fed and irrigation conditions. After 1990, there has been a phenomenal growth in irrigated areas in central part of Myanmar. Dam is a barrier constructed to hold back water and raise its level, forming a reservoir used for water supply. It is an artificial reservoir where rainwater are collected.

In Daik-U Township, Pinyinon Dam was completed in May, 1988 and this dam was built across the Pinyinon creek. Four dams namely Pinyinon Dam (completed in 1988), Bawni Dam (in 1999), Kawliya Dam (in 2004) and Bindar Dam (in 2004) in the study area can be used for irrigation purposes. Although Bindar dam is located in the Kyauktakar Township, its irrigated area is found in Daik-U Township.

Research Problem

Summer paddy cultivated areas is double cropping cultivation le land and repeated cultivation faced with the soil fertilizer decreasing. Therefore, more fertilizer and pesticide are used to meet high yield of paddy and challenged with the increasing soil salinity area on summer paddy land.

Aim

The aims of this paper are to present the summer paddy cultivation conditions in Daik-U Township to describe the negative impacts as soil fertilizer decreasing and other effects on summer paddy land of the study area.

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Research method

The secondary data including four dams and its irrigated areas and rainfall data are obtained from Irrigation Department, Department of Agriculture and Land Management Statistics in Daik-U Town and relevant thesis.

Twenty two village tracts were selected and 242 farmers from these village tracts answered and 22 persons did not respond. The questionnaires were distributed and responses were taken, field observation was conducted to get necessary information on from 30.3.2019 to 1.4.2019 and from 8.4.2019 to 11.4.2019. Personal interviews with village leaders and head of the village concerned, Department of Agriculture and Land Management Statistics and Irrigation department (Daik-U Township) were arranged using the field study period. SWOT analysis method is used to comprehensively know the positive and negative impacts of irrigated area by discussion with farmers of 22 village tracts.

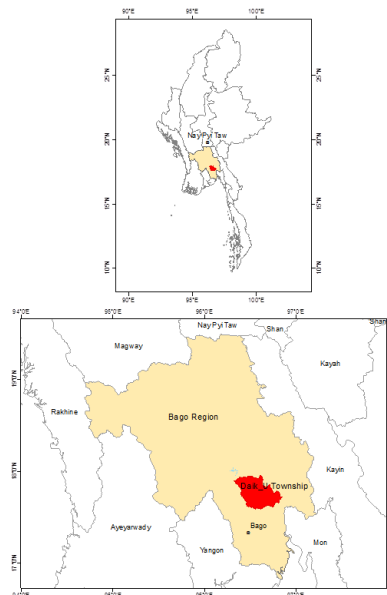
Previous Investigation

Mon Mon Htay (2012) studied ‘Geographic Analysis of Agriculture in Daik-U Township in her PhD Dissertation submitted to the Department of Geography, Yangon University. This paper described land utilization and cultivated crops, cropping pattern and effects of agriculture on socio-economic condition. In studying on agriculture, summer paddy cultivation from 2000 to 2010 and production and dams are lesser written.

Physical Bases of Study Area

Location and Size

Daik_U Township is located in the southeastern part of Bago Division. It is situated between 17°34' and 17°58' north latitudes and 96°10' and 96°52' east longitudes. It is bounded by Kyauktaga Township on the north, Nyaunglaypin Township on the northeast, Waw Township on the southeast, Bago and Waw Townships on the south, and Bago Township on the southwest and west. The coverage area of this township is 1287.31 square kilometers.



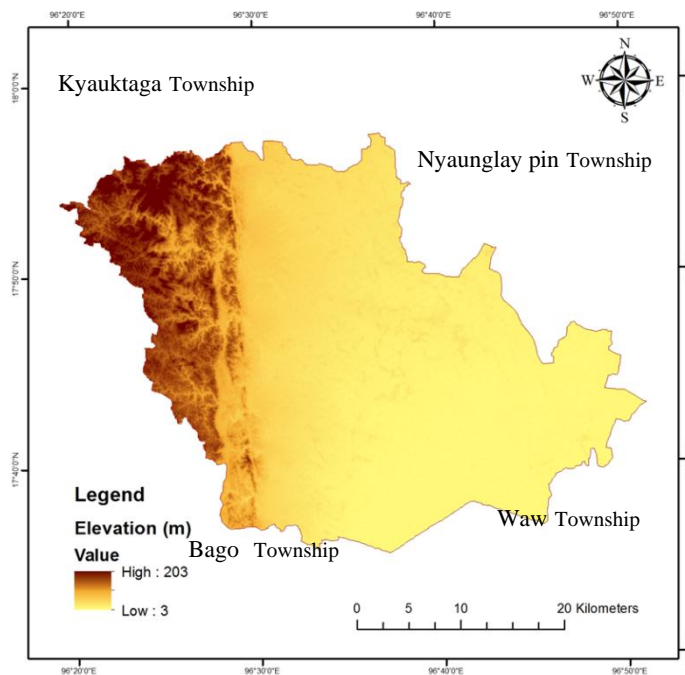
Source: MIMU

Figure 1 Location of Daik-U Township in Bago Region

Relief and Drainage

The hilly upland which is extension of Bago Yoma occupies the northwestern part. Most area of this township is covered with low-lying plain. The high rate of upland soil erosion reaches to the lowland with high sediment loads.

Most of the large streams that flow through the township take their sources over the Bago Yoma. The relatively large streams are Bindar, Kawliya, Katoke and Bawni. These Creeks take their sources on the eastern slope of Bago Yoma and they flow from west and northwest to east and southeast. Binder creek is about 56.32 kilometers long, 36.58 meters wide and 1.82 meters deep in average. Kawliya Creek has a length of 72.4 kilometers and a breadth of 24.39 meters. Koteke Creek is 41.8 kilometers long and 24.39 meters wide and Bawni Creek has a length of 40.2 kilometers and a width of about 30.48 meters.



Source: DEM

Figure 2 Relief Map of Daik-U Township

Climate

As Daik_U has no weather station and the climatic data are taken from Bago station. The mean monthly temperature is highest in April with 31° C (85° F) and lowest in December 23.7° C (74.66°F).The maximum daytime temperature often reaches 40° C in the later part of hot dry season. The total annual rainfall from 2003 until 2013 was 3543 mm. The heavy rainfall received in June (631 mm), July (771mm) and August (756 mm) from 2003 to 2017.

Table 1 The Temperature and Rainfall in Bago Station (from 2003 to 2017)

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average/ Total
Maximum Temperature (° C)	31.50	33.7	36.4	37.5	34.8	30.5	29.9	29.4	30.8	32.1	32.1	30.7	32.4
Mean Mini Temperature (° C)	16	16.9	20.5	23.5	24.3	23.5	23.6	23.5	23.7	23.1	20.9	16.7	21.3
Mean Annual Temperature (° C)	23.75	25.3	28.4	30.50	29.50	27	26.4	26.7	27.1	27.6	27.5	23.7	26.9
Rainfall (mm)	0.51	7.11	7.62	38.86	319.53	631.7	771.7	756.67	497.8	449.8	52.58	9.4	3543

Source: Meteorology Department, Bago

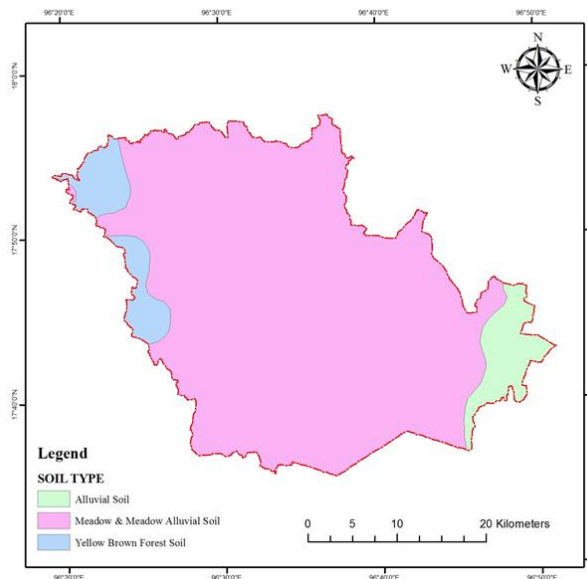
Soil

The most dominant soils are alluvial soil, meadow and meadow alluvial soil and yellow brown forest soil. Meadow and meadow alluvial soil is the most leading soil in irrigated area.

Finding and Discussion

Dams and its Irrigated Area

Four dams namely Pyinpon Dam (completed in 1988), Bawni Dam (in 1999), Kawliya Dam (in 2004) and Bindar Dam (in 2004) in the study area can be used for irrigation purposes. Although Bindar dam is located in the Kyauktakar Township, its irrigated area is found in Daik-U Township. Summer paddy cultivated area is supported and cultivated by using the irrigated water. After the increased availability of irrigated water, the sown area of summer paddy had been increased.



Source: Soil Department in Daik-U Township

Figure 3 Soil Map of Daik-U Township

Bindar Dam- This dam provided the highest amount of irrigated water for growing the summer paddy in Daik-U Township. The average sown area of summer paddy in 10 year period from 2007-08 to 2017-18 was 2253.7 hectares. The sown acreages under summer paddy was 1356 hectares in 2011-12 and it was the lowest irrigated by the water of this dam. The highest summer paddy cultivated area was in 2009-2010 with 4351.4 hectares. The highest amount irrigated area is related with completed period (in 2004).

Bawni Dam- According to available figure, the average sown area of summer paddy in 10 year period from 2007-08 to 2017-18 was 1791.6 hectares. The sown acreages of summer paddy in Bawni irrigated area has been decreased since 2011-12 and then summer paddy cultivated area gradually decreased to 1239 hectares in 2015-16 in Bawni irrigated area. In 2017-18, of the 46 village tracts, 32 village tracts cultivated more or less summer paddy. Among the village tracts that received irrigation water from Bawni Dam, Bawni village tract had the highest summer paddy growing area with 668.46 hectares in 2017-18. The summer paddy growing village tracts with second highest rank were Phyineshay Village Tract (334.85 Hectares) and Tamangyi Village Tract (350.6 Hectares). Other village tracts that cultivated summer paddy with irrigated water supply of Bawni Dam are Kadote Ywama (277.6 hectares), Kadote Phayargyi (264.7 hectares), Pynmalwin (91 hectares), Kankalay (54 hectares) and kokkaing (49 hectares) respectively.

Table 2 Irrigated Hectares of each Dams in Daik-U Township (From 2008-09 to 2017-18)

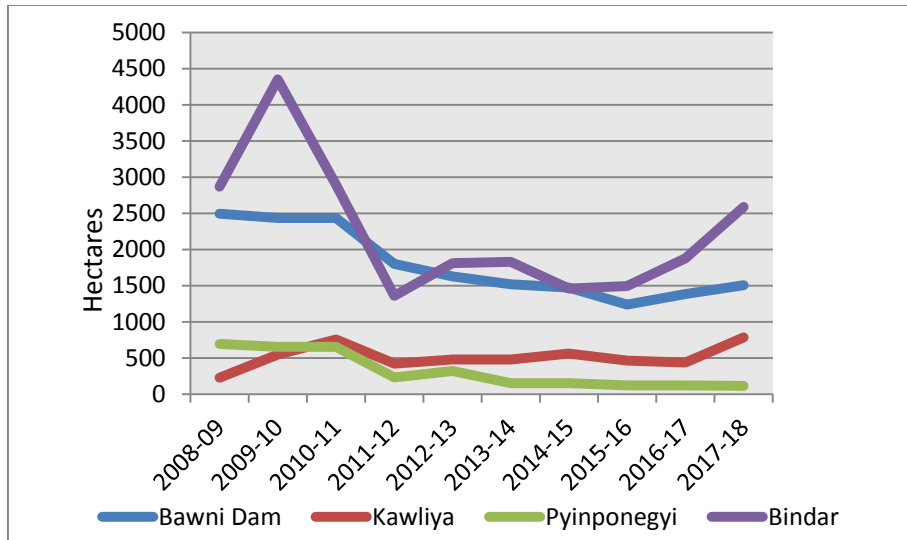
Years	Sown Area (Hectares)			
	Bawni	Kawliya	Pyinpone	Bindar
2008-09	2494.6	228.2	695	2869.3
2009-10	2435.6	548.1	653.7	4351.4
2010-11	2435.6	756.4	653.5	2892.9
2011-12	1800	422	232.8	1361
2012-13	1629	478.8	319.5	1812.4
2013-14	1518.7	478.8	151.9	1829.8
2014-15	1473	562.2	151.4	1460.1
2015-16	1239	465.1	120.3	1495.4
2016-17	1383.8	438.6	120.3	1877.2
2017-18	1507	784.2	114.1	2587.9
Average	1791.6	516.2	321.2	2253.7

Source: Irrigation Department, Daik-U

Pyinpon Dam- The average sown acreages of summer paddy in Pyinpon irrigated area has 321.2 hectares during 10 year period from 2008-09 to 2017-18. The sown acreages of summer paddy in Pyinpon irrigated area has been decreased since 2011-12 and then summer paddy cultivated area gradually decreased to 114.1 hectares in 2017-18 in Pyinpon irrigated area because this dam had been completed and irrigated since 1988 and it used long time period. There were three village tracts which contain Phayarkyi Kwin (87.13 hectares), Kyaikzakaw Anauk (66.39 hectares) and Tamangyi (12.45 hectares).

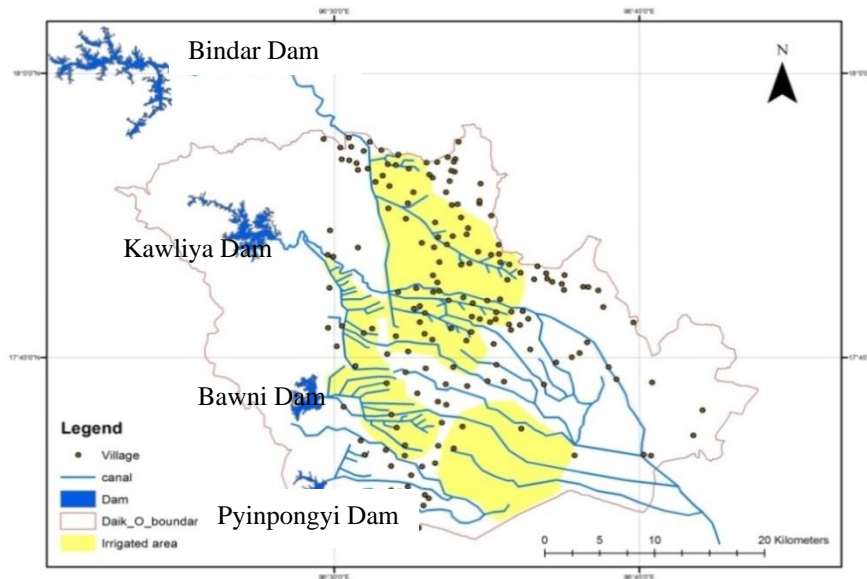
Kawliya Dam- According to table 2, the average sown acreages of summer paddy in this irrigated area has 516.2 hectares during 10 year period from 2008-09 to 2017-18. The sown acreages of summer paddy in Kawliya irrigated area has been progressively increased during the

ten year period from 2007-08 to 2017-18 because this dam was completed in 2004 and the increasing paddy price. Outline area that used the irrigation water from this dam had 784.2 hectares in 2017-18 and this irrigation water were sent to Pwetamot (282.16 hectares), Kankalay (112.45 hectares), Kawliya (75 hectares) and Kokkaing village tracts (314.1 hectares).



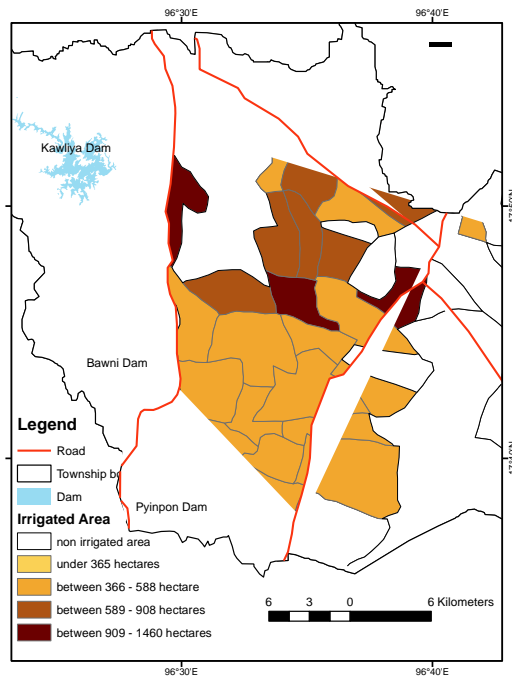
Source: Irrigation Department, Daik-U.

Figure 4 Changing Conditions of Irrigated Area from 2008-09 to 2017-18



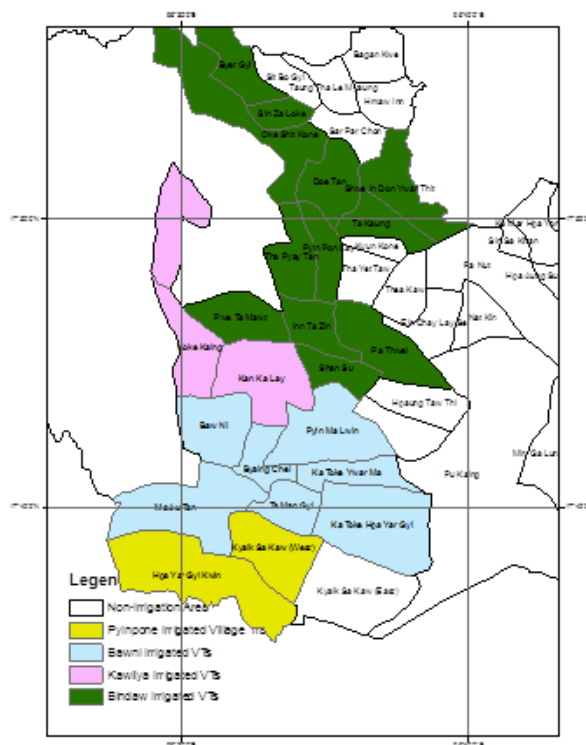
Source: Irrigation Department, Daik-U

Figure 5 Distribution Maps of Dams and Its Irrigated area in Daik-U Township



Source: Based on data obtained from Irrigation Department, Daik-U

Figure 6 Distribution of Summer Paddy Hectares by Village Tracts (2017-18)



Source: Based on data obtained from Irrigation Department, Daik-U

Figure 7 Distribution of Summer Paddy cultivated Village Tracts of each Dams (2017-18)

Effect of Dams and its irrigated Area

Based on 242 responds in 22 village tracts of summer paddy cultivation, the positive and negative effects of dams irrigated area can be found in Daik-U.

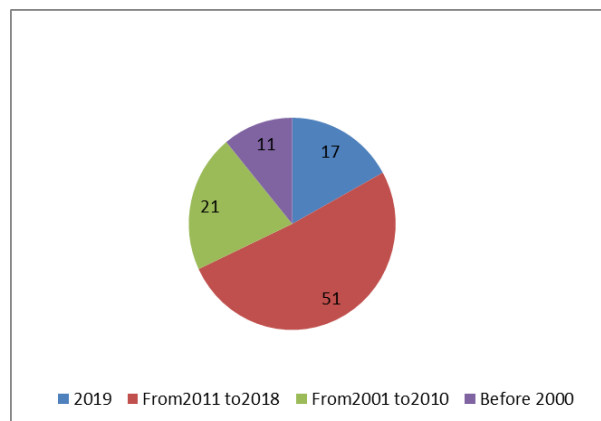
Positive Effects of Dams irrigated Area in Daik-U Township

The increased summer paddy cultivated area is studied by dividing four periods (Before 2000, during the period between 2001 and 2010, during the period between 2011 and 2018 and in 2019). Eleven percentage or 27 respondents taking place and grew the summer paddy before 2000 until present time, 21% respondents started and cultivated during the period between 2001 and 2010. The fifty-one percentage of all answers began and cultivated during the period between 2001 and 2018 which indicated that the increasing percent is 6.37% of respondents in one year in that time increased to summer paddy farmers. About 17% of summer paddy respondents started to cultivate in 2019. Therefore, the summer paddy cultivated farmers increased in 2019 because this cultivation not only can get more income, but also need small numbers of labors.

According to questionnaires result, the answers by 110 farmers or 45% of irrigated cultivated farmers, their summer paddy cultivation area slowly increased from the start time until present time. Other 142 farmers or 55% answered that the acreage under the summer paddy cultivation has been unchanged since the start of cultivation time. Farmers are eager to grow the summer paddy because it uses only small number of labors, aiding by machines.

Among the respondents, 124 replied that summer paddy cultivation provides more income, but 118 farmers replied this cultivation does not bring in good income. Income is related with low and high price of paddy and farmers expect to get high price for their paddy. Therefore, the increasing or decreasing of the acreages under summer paddy is related with paddy price.

According to the responses of 208 farmers, they can do the educational assistance to their children, 22 farmers faced with cash scarcity and other 12 do not have child.



Source: Questionnaires results

Figure 7 Extensions of Total Summer Paddy Cultivation Area Based on Cultivated Year

About 99 percent of farmers use agricultural machines and it indicated economic development of rural. But it decreased the numbers of cows and buffaloes. Only 99 farmers or 40.9% of total farmers own agricultural machines and other 59.1% used by lending the necessary agricultural machines.

Among the households of respondents, 185 households are difficult to repair their houses and others can repair their houses. But some houses are not necessary to repair because these houses are good and of high class.

Negative Effects of Summer Paddy Cultivation on Le Land in Study Area

Only 45 households or 18.59% answered that chemical fertilizer and pesticide were used on farming with suitable amount and other 193 or 81.41 % used more and more chemical fertilizers and pesticides due to soil fertilizer reduction, decreasing numbers of cows and buffaloes and more paddy production. Therefore, the fertilizers and pesticides use on *le* farming has past the allowable limit and it indicates to the destruction of soil structure and environment.

The numbers of cows and buffaloes sharply decreased because most farmers used agricultural machines for summer paddy farming. 177 households or 73.14% witnessed decreased in the numbers of cows and buffaloes, 46 households remain unchanged in the numbers of their livestock and 12 households possess more cows and buffaloes. Other 7 households did not response to this question.

According to 62 respondents, water for drinking and household uses is available abundantly and 175 respondents sufficient among. Other 5 answered that water available for drinking and household use is low in quality. As a result, water for drinking and household use water is not potable.

Of the respondents, 131 replied that more weeds grow on *le* land after irrigated cultivation, 70 respondents answered unchanged situation and other 41 persons perceived the reducing weeds on *le* land. According to the answers, it is related not only with irrigated water but also with the use of weed killing herbicide.

Of the total respondents, 228 or 94.21% responded that there is no sediment deposition on *le* land after irrigated farming. Other 14 persons replied the more concentration of sediment deposition on *le* lands because their *le* lands were faced with periodic flood and deposition large of sediment on *le* land.

Some 20 farmers replied that there is increased salinity on *le* land and other 222 respondents answered there is no high salinity on *le* land after irrigation. It is related to lack of information and applied laboratory results.

Among 45 respondents reacted that their agricultural lands become drier after irrigation, 147 persons said their *le* lands are unchanged but decreasing dry land area resulted in of 30 farmers' land. The variances of this result concerned with the locational differences and some farm lands are located far from drainage channel and highness of land area.

According to 48 farmers the stream overflow conditions occur on *le* land one or two or three times in one year because of *le* broken barriers and lowness of land area. Other 194 persons answered that they did not face flood condition after irrigated agriculture. After irrigation, 242 households or 100% have to face the problem of the abundance of mosquitoes but they have not been affected by the mosquitos' related diseases until present time.

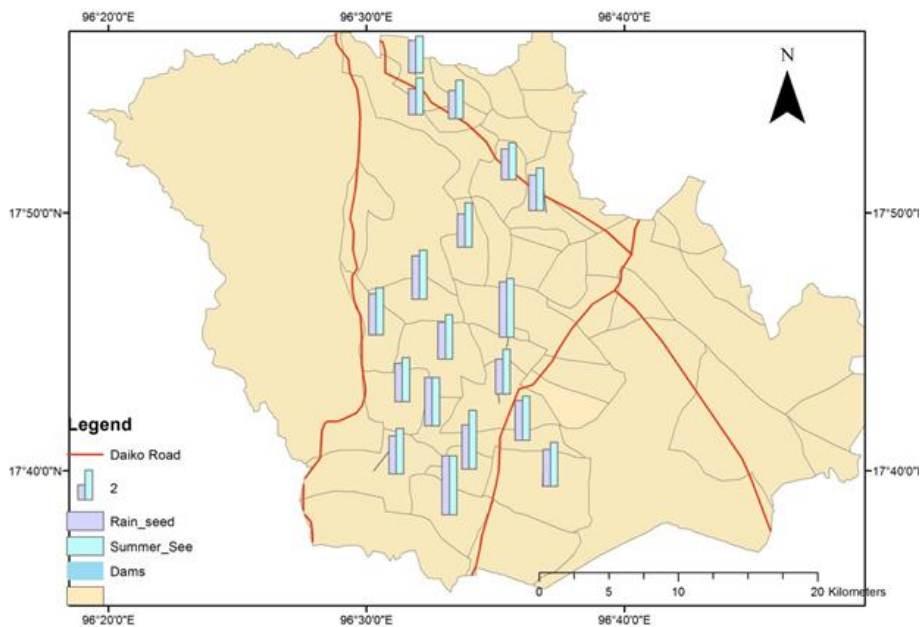
Comparative Study on Rainfed and Summer Paddy Cultivation

ploughed cost per hectare, used baskets of seed, used chemical fertilizer, pesticides, growing price, weeding, other worker uses, yield per acres, cost of harvesting, cost of mattock, production basket per acre price are studied to know the differences of the rainfed and summer paddy cultivation. Ploughed cost per hectare, weeding, cost of harvesting, cost of mattock, weeding and other worker uses are similar in the rainfed and summer paddy cultivation.

The used seed for summer paddy cultivation is more than rainfed growing. Among 231 respondents, 72 farmers scattered seed the same basket during the two periods. But other 159 responses or 68.83 percent answered that the growing seeds for summer paddy cultivation are more than rainfed paddy cultivation. They used more half until two baskets in summer paddy cultivation time. Figure (8) described that used seed per acre for summer paddy cultivation is more than rainfed growing by village tracts. More use to seeds indicated that the reduction for cost for growing because it scattered seed during the summer season. But all farmers spread seeds in summer season.

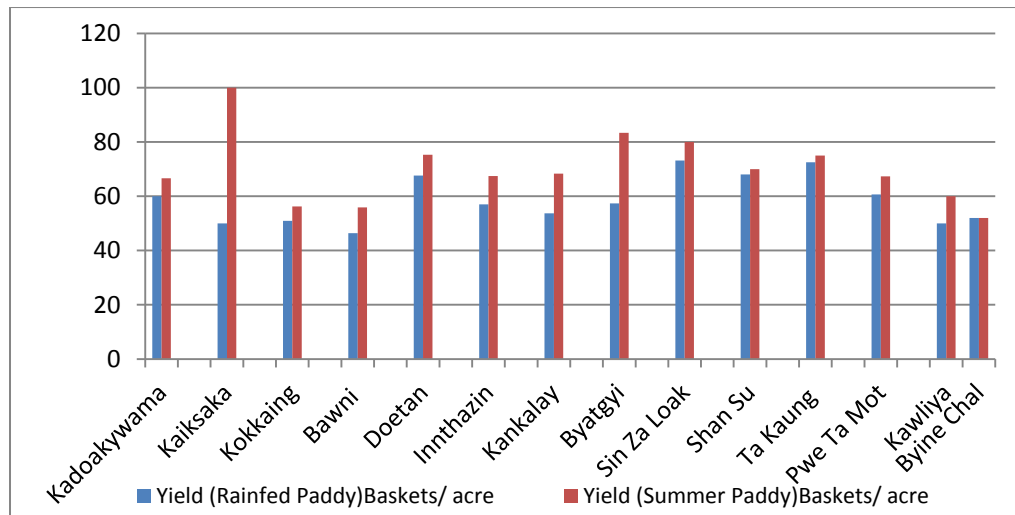
Among 231 persons who used chemical fertilizer for summer and rainfed paddy, all people used one bag to four bags per acre for paddy cultivation. But, 155 farmers or 67 percent used the same amount for summer paddy and rainfed paddy and other 33 percent filled more chemical fertilizer in summer paddy cultivation.

The yield per acre is important for summer paddy cultivation because increasing area is entirely related with price and yield. The yield per acre of summer paddy cultivation is more than rainfed paddy.



Source: Questionnaire Result

Figure 8 Compares the Used Seed per acre between Summer Paddy and Rainfed Paddy Cultivation by Village Tracts



Source: Questionnaire Result

Figure 8 Compares Yield per acre between Post Monsoon and Rainfed Paddy Cultivation by Village Tracts

SWOT Analysis on Dams irrigated Area in Daik- U Township

Strength and opportunities of summer paddy cultivation are the increasing income and poverty reducing, more motivations on education of children and housing style, high yields of summer paddy than rainfed paddy. In 2019, the summer paddy price decreased and farmers faced with non-profit and low profit. More and more use of fertilizer, pesticide and herbicide caused soil degradation and salinization. Abundance of mosquitoes is facing problems in all village tracts and it threatens public health. Water Logging and flood can be found and some area happened until three or four times in one year. The decreasing of sediment and lessening of cow and buffaloes caused the loss of soil fertility.

SWOT analysis method

<p><u>Strength</u></p> <ul style="list-style-type: none"> - Income increasing - Poverty declining - More support on education of children - Upgrading and repair houses - Buying new agricultural machines - More yields of paddy in summer 	<p><u>Weakness</u></p> <ul style="list-style-type: none"> - Decrease in the price of paddy in 2019 - Non-profit and low profit in 2019 - Traders’ monetary control plan - Decreasing numbers of cows and buffaloes - Reducing of muck and bio-fertilizer - Requirement of crop rotation for sustainable agriculture
<p><u>Opportunities</u></p> <ul style="list-style-type: none"> - Moderate Population concentration in villages - More upgrading of villages’ infrastructure - Improvement of new paved roads in villages - Get loan from government 	<p><u>Threat</u></p> <ul style="list-style-type: none"> - More and more use of Fertilizer and Pesticide - Abundance of mosquitoes(Adverse public health) - Embankments cause sedimentation decreasing - Water Logging - More herbicide use - Increase of soil salinization on summer paddy land - Facing frequent flood

Source: Interview Results

Conclusion and Suggestions

Daik-U Township is located in the southeastern part of Bago Division. Pyinpon, Bawni, Kawliya and Bindar dams for irrigation purposes in the study areas are located on the foothill of Bago Yoma and its irrigated area can be found in the lowland area of central and eastern parts of Daik-u township. The average sown irrigated area from 2007-08 to 2017-18 was 2253.7 hectares (Binder irrigated area), 1719.6 hectares (Bawni irrigated area), 516.2 hectares (Kawliya irrigated area) and 312.2 hectares (Pyinpone dam irrigated area) that are distributed in the central part of this township. According to 242 summer paddy farmers in 22 village tracts, 17% standed summer paddy cultivation in 2019. Therefore, the summer paddy cultivated area has increased in 2019 because this cultivation not only can bring in more income, but also need small number of workers.

Strength and opportunities of summer paddy cultivation are the increasing income and poverty reducing, more motivations on education of children and upgrading of housing style, high yields of summer paddy than rainfed paddy. In 2019, the summer paddy price decreased and farmers faced with non-profit and low profit. More and more use of fertilizers, pesticides and herbicide caused soil degradation and salinization. Abundance of mosquitoes is causing problems in all village tracts and it threats public health. Water Logging and flood can be found and some area witnessed three or four times in one year. The decreasing sediment and lessening of cow and buffaloes caused the loss of soil fertility.

Suggestions

Government should take effort to improve the paddy trading to get more profit and paddy traders need to fix stable price for development of farmer livelihood.

Farmers should undertake to develop the using of bio-peats and to decrease the use of chemical fertilizer. Therefore, farmers should practice to increase the the numbers of cows and buffaloes.

Irrigation department of Daik-U should take effort to be able to distribute more irrigation water to the farmers.

Some fertilizer and pesticide distributed companies should take care of soil condition and to be selling more effective fertilizer and pesticide which cause least soil degradation.

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