MONSOON PADDY CULTIVATION IN KYAING TONG TOWNSHIP

Nilar Aye [1], Ni Ni Lwin[2], Mya Thin Moe[3], Aye Sandy Kyaw[4], Nan Nu Nu Yee[5]

Abstract

Kyaing Tong is one of the five townships of Kyaing Tong District, and is located in Eastern Shan State, Myanmar. Physical condition of the township is composed of many hilly areas and a few flatlands. The region experiences Humid Subtropical Climate. This study focuses mainly on the spatial variation of monsoon paddy cultivation in Kyaing Tong Township. In this research paper, Weaver's crop combination method and relative yield and relative spread indices are calculated based on cropped area and yields. According to Weaver's method there are 5 crop combination areas in Kyaing Tong. Based on 2022-23 data, 18 village tracts were monsoon paddy high yield-high spread areas, 9 village tracts- high yield- low spread areas, 2 village tracts- low yield- high spread areas and 3 village tracts- low yield- high spread areas. Besides, geospatial techniques used to identify the most productive and suitable areas for crop production and spread.

Keywords*:* Kyaing Tong, monsoon paddy, relative yield indices, relative spread indices, Weaver's crop combination method

Introduction

Kyaing Tong Township is situated in Eastern Shan State and belongs to the easternmost part of Myanmar. It is located between latitudes 20º 58′ N and 21º 35′ N and also between Longitude 99º 16′ E and 99º 58′ E. The area is covered by 3,783.31 square kilometres or 1,460.74 square miles. The elevation is 531 meters above sea level.

Based on the relief, the drainage pattern is typically distributed in the centre of the study area. The stream flows to the north direction accordingly. Thus, the cropping pattern is more tremendous and concentrated on the levelling plain area than any other the peripheral rugged region because of the marginal areas of the township are higher lands.

The equal proportions of silt and clay are also contained and richer in plant nutrients. The Meadow Alluvial Soils are also suitable for groundnut, sesamum, sunflower, jute, sugarcane and vegetables other than paddy. The relief and climatic conditions of Kyaing Tong are composed of lofty mountains these are favourable to shifting cultivation especially monsoon paddy and other crops and rubber plantation.

The total area of Kyaing Tong Township is 934,977 acres (378,371.8 hectares) or 1,460.9 square miles. In 2022-2023 data, 8.57 percent or 80089 acres is used for cultivated Land, 13.43 percent or 125595 acres for cultivable virgin land, 17.25 percent or 161283 acres for forest land, 28.5 percent or 266448 acres with unclassified forest and non- cultivated land amounted to 32.25 percent or 301,562 acres of Kyaing Tong Township area. According to the data, average land-man ratio for the whole township is about 0.3 acre per person in 2022-2023.

Monsoon paddy is the dominating constituents in the first ranking crop combinations or monoculture, which covers all of the village tracts in township. In Kyaing Tong Township, of the

[1] Department of Geography, Kyaing Tong University
[2] Department of Geography, Kyaing Tong University
[3] Department of Geography, Kyaing Tong University
[4] Department of Geography, Kyaing Tong University
[5] Department of Geography, Kyaing Tong University

total cultivated area of 80089 acres, 47988 acres represent the monsoon paddy net sown area, i.e., about 60 per cent. In order of area covered, the most important crops are monsoon paddy, rubber, maize, corn, groundnut and soyabeans. Crops occupying less than one per cent of the gross cultivated area have not been included as they occupy an insignificant area.

Study Area

Kyaing Tong Township is situated in Eastern Shan State and belongs to the easternmost part of Myanmar. It is located between latitudes 20º 58′ N and 21º 35′ N and also between longitudes 99º 16′ E and 99º 58′ E. The area is covered by 3,783.31 square kilometres (1,460.74 square miles). It is bounded on the north by Mong Khat Township, on the north-east by Mong Lar Township, on the southeast by Mong Phyat Township, on the northwest by Mong Hsat Township and on the west by Mong Pyin Township.

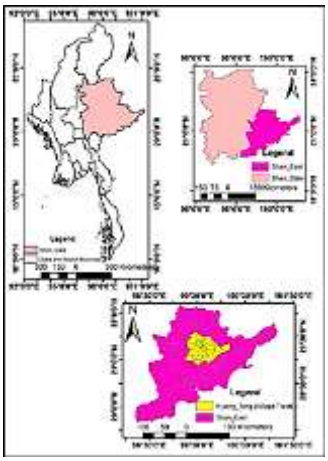

Figure 1. Location of Kyaing Tong Township

Source: Myanmar Information Management Unit (MIMU_2021)

Aim

The aim of this research is to present the spatial distribution of monsoon paddy cultivated areas in Kyaing Tong, the first ranking crop.

Objectives

The objectives are to present the crop combinations of Kyaing Tong by Weber's method, and to calculate and explore the relative yield and relative spread indices (Jasbir Singh & S.S. Dhillon) and their distributional areas.

Materials and Methods

The primary data are acquired through field observation and secondary data from the relative offices of Township General Administrative Office, District Immigration Office and Agricultural Land Management and Statistics Department of Kyaing Tong Township. The acquired data are organized and analyzed by figures, and questionnaire method, simple statistical methods in descriptive and explanatory forms are presented. In this research, Weaver's crop

combination method and relative yield and relative spread indices are calculated based on cropped area and yields by Jasbir Singh & S.S. Dhillon (2004).

Results and Discussion

Depending on the terrain, topography, slope, temperature, amount and reliability of rainfall, soils and availability of water for irrigation, the cropping patterns vary from place to place in Kyaing Tong. The perception and assessment of environment also guide to grow certain crops in this area. Those areas of the study area where physical diversities are less, the cropping patterns are less diversified. For example, in the steep slope areas of the village tracts in Kyaing Tong, the farmers grow coffee or tea leaf or millet, while in the valley or near from creeks areas, monsoon paddy is the dominant crop.

The cropping patterns of the study area or areal unit may be determined on the basis of areal strength of individual crops. (Jasbir Singh & S.S. Dhillon (2004): "Agriculture Geography" and Grigg, D. (1995): *"*An Introduction to Agricultural Geography**"**) The first and second ranking crops of an areal unit may be called as the dominant crops of that unit or the study area. These crops, if occupying more or less the same percentage of the total cropped area, shall be competing for area with each other and the farmer will decide which crop may fetch him more profit in a given year under the prevailing rainfall and demand, supply and commodity price condition. In general, for the determination of cropping patterns of a region, the minor crops (crops occupying insignificant proportion of the total cropped area) are eliminated.

In this research, computed the percentage of total cultivated lands occupied by each crop that held as much as 1 per cent of the total cultivated land in each of the 32 village tracts covered in the study area. Excluding a few village tracts like Yang Kying, Kat Taung, Wut Sawng, Kat Htaik, Yang Law, Loi Long, Kat Hpa, Mong Lat and Urban area in which the crop combination was easy to ascertain of monoculture, other village tracts showed a complex and confused picture of the percentage, occupied by different crops.

In this work, calculated deviation of the real percentages of crops (occupying over 1 per cent of the cropped area) for all the possible combinations in the component areal units against a theoretical standard by Weaver.

The deviation of the actual percentages from the theoretical curve is seen to be the lowest for a 5-crop combination. This result established the identity and the number of crops in the basic combination for the Kyaing Tong Township as monsoon paddy, rubber, maize, soyabean and groundnut.

The resultant cropping patterns plotted in Figure 2 are crop combination areas by village tract. The application of Weaver's method gave 5 crop combination areas in Kyaing Tong. The village tracts falling into different crop associations are given in Table 1.

Table 1. Kyaing Tong: Crop Combination Areas, 2022- 2023

No. of Crop	No. of Village Tracts	Names of the Village Tracts
Monoculture	9	Yang Kying, Kat Taung, Wut Sawng, Kat Htaik, Yang Law, Loi Long, Kat Hpa, Mong Lat and Urban
2	3	Mong Lan, Nawng Kon, Mong Zin
3	2	Mong Naw/ Hpar Ta, Nam Khat
4	1	Nam Inn
5	17	Tar Lu / Tar Lay, Mong Kaing, Wut Swng, Loi Mway, Pin Tauk, Pang Mat, Mong Pang (Middle), Pang Kyu, Mong Ngun, Mong Inn, Yang Hka, Nam Ni / Nam Long, Nar Paw, Naung Taung, Hway Kwei, Mong Hkun, Mong Pat (Upper), Mong Pat (Lower)

Source: Agricultural Land Management and Statistics Department, Kyaing Tong

Weaver's method has admirably been accepted and applied for the demarcation of crop combination and agricultural regionalization as its application results into suitable and accurate grouping of crops. The technique, however, gives most unwieldy combinations for the units of high crop diversification.

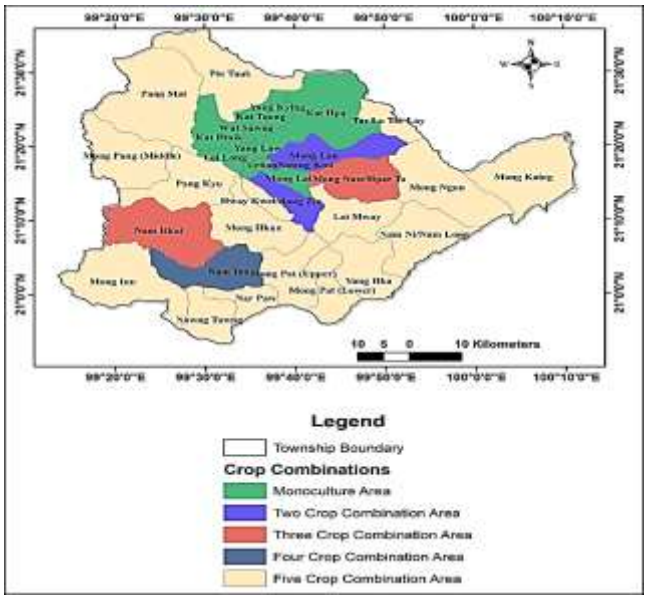

Figure 2. Kyaing Tong: Crop Combination Areas, 2022- 2023

(Weaver's Standard Deviation Method)

Source: Table 1

Such a problem of generalized crop combination was met in 9 village tracts of Kyaing Tong. In two, out of them, Wut Sawng Village Tract and Urban, the decrease in the variance was identical i. e., the value of 4 (Table 2) where every crop occupying as much as 1 per cent of the gross cultivated area was included in the combination to produce the lowest variance.

Table 2. Weaver's Method: Variance Values

Village Tract	Variance Values				
	Monoculture	**2-crop combination**	**3-crop combination**	**4-crop combination**	**5-crop combination**
Hway Kwei	1296	782.5	588.89	494.5	443.8
Kat Hpa	484	1004.5	1044.623	937.5	
Kat Htaik	324	1480	1287.423	1092.75	943.4
Kat Taung	49	2076.5			
Loi Long	81	1853	1741.157		
Loi Mway	2601	613	317.9567	263.25	241.592
Mong Hkun	2025	1025	750.49	589.5	484.4
Mong Inn	7569	1789			
Mong Kaing	3364	914	469.1567	335.75	
Mong Lan	1936	180	402.89	423.75	
Mong Lat	625	1034.5	1036.89		
Mong Naw/Hpar Ta	3969	246.5	116.7567	154.25	170.4
Mong Ngun	7225	1494.5	538.3567	259.75	159.6
Mong Pang (Middle)	1849	785	566.3567		
Mong Pat (Lower)	2209	1017	682.49		
Mong Pat (Upper)	2704	802	519.9567	398.75	324.2
Mong Zin	961	212.5	756.09		
Nam Hkat	7396	1752.5	736.2233		
Nam Inn	7225	1625	684.6233	367	
Nam Ni/Nam Long	1849	992.5	684.09	536.5	455
Nar Paw	6561	1538.5	660.3567	361.25	224.8
Nawng Kon	1444	144	530.3567		
Nawng Tawng	5776	1442.5	640.89		
Pang Kyu	961	902.5	804.8733		
Pang Mat	2500	882			
Pin Tauk	1764	716.5	506.49	421.25	378.2
Tar Lu Tar Lay	3969	966.5	466.3567	298.5	228.6
Urban	4	1730	1619.29		
Wut Sawng	4				
Yang Hka	1849	1037	721.1567	566.25	466.2
Yang Kying	225	1670.5	1483.157	1252.25	1069.6
Yang Law	16	2070.5			
Township Level	**1600**	**1018**	**753.0233**	**614.2225**	**517.778**

Source: Agricultural Land Management and Statistics Department, Kyaing Tong

In the remaining seven village tracts (Yang Kying, Kat Taung, Kat Htaik, Yang Law, Loi Long, Kat Hpa, Mong Lat), the value of variance does not show gradual decline. In these village tracts the variance decreases up to a few places from where it increases and then decreases again so as to surpass even the former decrease.

Weaver's technique when applied at the village tract level for the period of 2022- 2023 gives five crop combinations to Kyaing Tong which have been plotted in Figure 2.

Apart from the proportion of area under a particular crop, their relative yields also guide the suitability of that crop in a given geoclimatic and cultural setting. (Dayal Edison, (1984): "Agricultural Productivity of India") The relative yield index and the relative spread index for the determination of suitability of crop may be calculated by applying the following formulas:

Relative Yield Index = $\frac{Mean\ yield\ of\ the\ crop\ in\ a\ component\ areal\ unit}{Mean\ yield\ of\ the\ total\ area}$ x 100

Relative Spread Index = $\frac{Area\ of\ the\ crop\ expressed\ as\ percentage\ of\ the\ total\ cultivated\ area\ in\ the\ areal\ unit}{Area\ of\ the\ crop\ expressed\ as\ percentage\ of\ the\ total\ cultivated\ land\ in\ the\ entire\ region}$ x 100 (Jasbir Singh & S.S. Dhillon (2004): "Agriculture Geography")

On the basis of these indices the suitability of the crop grown in Kyaing Tong area is ascertained. If the relative yield index is below 90 per cent, then it may be an inefficient crop and therefore should not be devoted more area to its cultivation.

In greater parts of Kyaing Tong, agriculture is still largely subsistent in character. Consequently, the food grain crops occupy over 80 per cent of the gross cropped area. Among the cereals monsoon paddy ranks firstly. Maize, groundnut, soyabean and rubber are also important. The subsistent cropping patterns of Kyaing Tong are based on utilization of the inherent fertility of the soil without the much use of modern inputs and technology because of mostly shifting cultivation types.

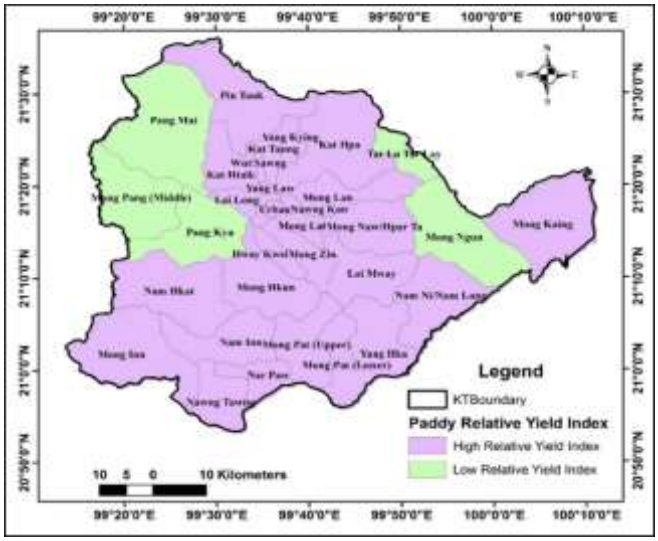

Figure 3. Monsoon Paddy Relative Yield Conditions for 2022-2023

Source: Agricultural Land Management and Statistics Department, Kyaing Tong

In this research, the relative yield index and relative spread index are calculated for monsoon paddy crops only for example. According to the 2022-23 data, paddy low relative yield village tracts or areas (relative yield index is below 90 per cent) are Pang Mat, Mong Pang (middle), Pang Kyu, Tar Lu/ Tar Lay and Mong Ngun village tracts. The remaining village tracts have high relative yield indices for monsoon paddy.

The horizontal expansion of agriculture is not possible without heavy capital investment and the study area situated on mountainous area. The change in the cropping pattern and introduction of crops which enhance the soil fertility are imperative to make agriculture more remunerative and sustainable.

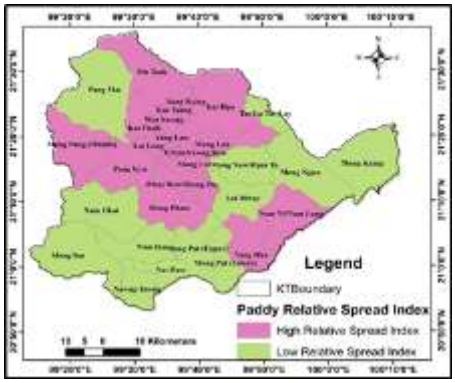

Figure 4. Monsoon Paddy Relative Spread Conditions for 2022-2023

Source: Agricultural Land Management and Statistics Department, Kyaing Tong

Crop concentration or relative spread of crop means the variations in the density or more cultivated area (hectare or acres) of any crop in an area/region at a given point of time. The concentration of a crop in an area largely depends on its terrain, temperature, moisture and pedological conditions. (Priyadharshini, S. Dr. and S.Aruchamy,S.(2014): "Agricultural Regionalization Based on Cropping Pattern in Sweta Nadhi Basin, Tamil Nadu") It has a tendency to have high concentration in the areas of ideal agroclimatic that monsoon paddy has high concentration elevation under 1198 meter in relief of the study area, and dominates near creeks and is the leading crop in Kyaing Tong. Besides, monsoon paddy grows well even with the help of minimum inputs, and thus has great significance for agricultural development and planning.

Table 3. Monsoon Paddy Relative Yield and Spread Indices

Village Tract	Paddy Acre	Total Cultivated acres	Relative Spread Index	Yield per Acre (bucket)	Relative Yield Index
Hway Kwei	373	587	111	81.41	94
Kat Hpa	4570	5896	136	86.69	100
Kat Htaik	4655	5702	143	88.93	103
Kat Taung	3156	3382	164	84.92	98
Loi Long	2979	3282	159	89.94	104
Loi Mway	1281	2627	86	81.37	94
Mong Hkun	2459	4464	97	88.41	102
Mong Inn	447	3365	23	82.01	95
Mong Kaing	406	978	73	84.68	98
Mong Lan	2161	3873	98	81.88	94
Mong Lat	1881	2497	132	90.16	104
Mong Naw/Hpar Ta	426	1162	64	77.84	90
Mong Ngun	104	688	27	77.22	89
Mong Pang (Middle)	1147	2005	100	67.35	78

Village Tract	Paddy Acre	Total Cultivated acres	Relative Spread Index	Yield per Acre (bucket)	Relative Yield Index
Mong Pat (Lower)	1287	2437	93	84.47	97
Mong Pat (Upper)	855	1792	84	80.54	93
Mong Zin	2103	3057	121	84.92	98
Nam Hkat	419	2940	25	89.7	103
Nam Inn	376	2567	26	89.78	104
Nam Ni/Nam Long	609	1071	100	79.96	92
Nar Paw	504	2619	34	84.2	97
Nawng Kon	233	378	108	89.21	103
Nawng Tawng	678	2808	42	90.27	104
Pang Kyu	1858	2686	121	76.08	88
Pang Mat	1080	2157	88	71.09	82
Pin Tauk	1675	2902	101	78.27	90
Tar Lu Tar Lay	270	730	65	73.3	85
Urban	385	392	172	88.72	98
Wut Sawng	3701	3784	172	89.83	104
Yang Hka	1126	1985	100	83.1	96
Yang Kying	2098	2469	149	85.52	99
Yang Law	2686	2807	168	86.7	100

Sources: Agricultural Land Management and Statistics in Kyaing Tong.

Within the study area, monsoon paddy low relative spread indices for 2022-2023 are Pang Mat, Nam Hkat, Mong Inn, Nawng Tawng, Nar Paw, Nam Inn, Mong Pat (upper), Loi Mway, Nong Nar/Hpar Ta, Mong Ngun, Mong Kaing and Tar Lu/ Tar Lay village tracts. Other village tracts have high relative spread areas for monsoon paddy in 2022-2023.

Findings and Suggestion

The area under each crop in a given region may be classified under four categories:

(i) High yield, high spread areas,

(ii) High yield, low spread areas,

(iii) Low yield, high spread areas and

(iv) Low yield, low spread areas.

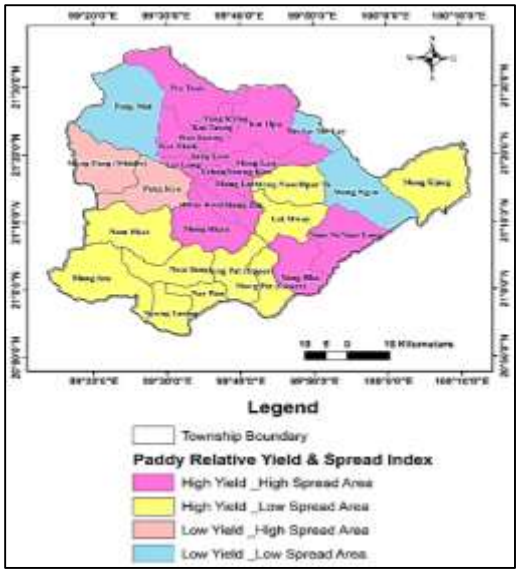

Figure 5. Monsoon Paddy Relative Yield and Relative Spread Areas in Kyaing Tong for 2022-2023
Source: Agricultural Land Management and Statistics Department, Kyaing Tong

Within the study area, monsoon paddy high yield- high spread areas are Pin Tauk, Yang Kyaing, Kat Taung, Wut Sawng, Kat Htaik, Yaung Law, Loi Long, Nawng Kon, Mong Lan, Kat Hpa, Mong Lat, Hway Kwei, Mong Zin, Mong Hkun, Yang Hka, Nam Ni/ Nam Long, Mong Pat (lower) village tracts and urban area.

High yield- low spread areas are Mong Naw/ Hpar Ta, Loi Mway, Nam Hkat, Mong Inn, Nam Inn, Nar Paw, Nawng Tawng, Mong Pat (upper) and Mong Kaing village tracts.

In Kyaing Tong Township, monsoon paddy Low yield- high spread village tracts in 2022-2023 are Mong Pang (middle) and Pang Kyu.

Low yield- low spread areas are Pang Mat, Tar Lu/ Tar Lay and Mong Ngun village tracts respectively.

On the availability of an alternative more efficient crop than the existing ones, new cropping patterns may emerge in an area. The cropping patterns may be intensified with the help of high yielding short duration varieties. Any cropping sequence to be adopted by the cultivators should be flexible.

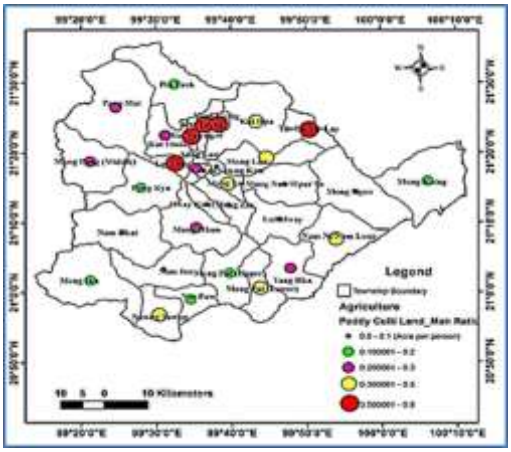

Figure 6. Paddy Cultivated Land- Man Ratio of Kyaing Tong
Source: Table 2

According to the data, average land- man ratio for the whole township is about 0.1 hectare per person (0.2 acre per person) in 2022-2023. Kyaing Tong urban area has total cultivated area of 155.8 hectare (385 acres) with total population over 58000 persons, therefore the ratio of cultivable land- man ratio 0.003 or zero acre per person. Paddy 0.2 hectare per person (0.1acre per person) areas found at Hway Kwei, Mong Naw/Hpar Ta, Loi Mway, Mong Ngun, Nam Hkat, Nam Inn, Mong Zin and Nawng Kon village tracts.

Table 4. Monsoon Paddy Cultivated Land- Man Ratio of Kyaing Tong

Village Tract	Total Population	Paddy Cultivated acres	Paddy Cultivated Land (acre per Person)	Paddy Cultivated Hectare	Paddy Cultivated Land (Hectare per Person)
Hway Kwei	3773	373	0.10	150.9	0.04
Kat Hpa	10328	4570	0.44	1849.4	0.18
Kat Htaik	13326	4655	0.35	1883.8	0.14
Kat Taung	5721	3156	0.55	1277.2	0.22
Loi Long	5310	2979	0.56	1205.6	0.23
Loi Mway	9072	1281	0.14	518.4	0.06
Mong Hkun	8812	2459	0.28	995.1	0.11
Mong Inn	2714	447	0.16	180.9	0.07
Mong Kaing	1837	406	0.22	164.3	0.09
Mong Lan	5934	2161	0.36	874.5	0.15
Mong Lat	4052	1881	0.46	761.2	0.19
Mong Naw/Hpar Ta	6255	426	0.07	172.4	0.03
Mong Ngun	2607	104	0.04	42.1	0.02
Mong Pang (Middle)	4181	1147	0.27	464.2	0.11
Mong Pat (Lower)	2901	1287	0.44	520.8	0.18
Mong Pat (Upper)	3618	855	0.24	346.0	0.10
Mong Zin	18326	2103	0.11	851.1	0.05
Nam Hkat	5584	419	0.08	169.6	0.03
Nam Inn	4881	376	0.08	152.2	0.03
Nam Ni/Nam Long	1621	609	0.38	246.5	0.15
Nar Paw	2989	504	0.17	204.0	0.07
Nawng Kon	2006	233	0.12	94.3	0.05
Nawng Tawng	1698	678	0.40	274.4	0.16
Pang Kyu	9782	1858	0.19	751.9	0.08
Pang Mat	3840	1080	0.28	437.1	0.11

Village Tract	Total Population	Paddy Cultivated acres	Paddy Cultivated Land (acre per Person)	Paddy Cultivated Hectare	Paddy Cultivated Land (Hectare per Person)
Pin Tauk	10506	1675	0.16	677.8	0.06
Tar Lu Tar Lay	336	270	0.80	109.3	0.33
Urban	58945	385	0.01	155.8	0.00
Wut Sawng	4556	3701	0.81	1497.7	0.33
Yang Hka	4369	1126	0.26	455.7	0.10
Yang Kying	3713	2098	0.57	849.0	0.23
Yang Law	9293	2686	0.29	1087.0	0.12
Township		47988	0.21	19420.1	0.08

Sources: Immigration and National Registration Department of Kyaing Tong District
Agricultural Land Management and Statistics in Kyaing Tong.

The ratio between 0.1 hectare per person and (0.2 acre per person) village tracts are Mong Inn, Mong Kaing, Mong Pat (Upper), Nar Paw, Pang Kyu and Pin Tauk. The village tracts over ratio of 0.1 hectare per person i.e., between 0.2and 0.3 paddy cultivated acre per person include Kat Htaik, Mong Hkun, Mong Pang (Middle), Pang Mat, Yang Hka and Yang Law village tracts. The ratio between 0.2 hectare per person and 0.3 hectare per person i.e., (0.5 acre per person) areas found Kat Hpa, Mong Lan, Mong Lat, Mong Pat (Lower), Nam Ni/Nam Long, and Nawng Tawng village tracts. Paddy cultivated land- man ratio over 0.3 hectare per person (over 0.6 acre per person) village tracts are Kat Taung, Loi Long, Tar Lu/ Tar Lay, Wut Sawng and Yang Kying respectively. (Table 2 and Figure 5)

The cultivation of monsoon paddy in Kyaing Tong Township especially paddy as the first ranking crop village tract testifies this fact. Nevertheless, in different parts of the study area, the physical environment reduces the choice of crops, either by prohibiting the growth of certain plants or by reducing their yield per unit area.

Analysis for the relationship between monsoon paddy cultivated lands and elevation of relief, high paddy cultivation lands are located on an elevation under 1449 meter above sea level. Elevation over 1449 meter above sea level areas had paddy cultivated areas under 678 acres. (Figure 7)

Analysis for the relationship between monsoon paddy cultivated lands and slope condition within the study area, most of the paddy cultivation lands are located on the slope under 10 degrees. Degree of slope over 10 degree areas had paddy cultivated areas under 678 acres. (Figure 8)

Thus, the cropping pattern is more tremendous and concentrated on the levelling plain area than any other the peripheral rugged region because of the marginal areas of the township are higher lands. The relief and climatic conditions of Kyaing Tong are composed of lofty mountains these are favourable to shifting cultivation especially monsoon paddy and other crops and rubber plantation.

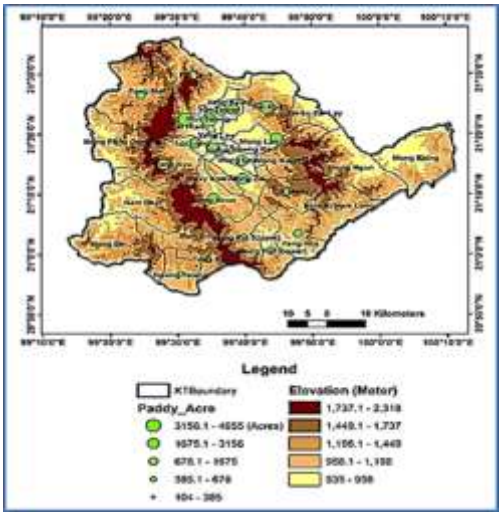

Figure 7. Relationship between Monsoon Paddy Cultivated Land and Elevation

Source: Table 4 and DEM

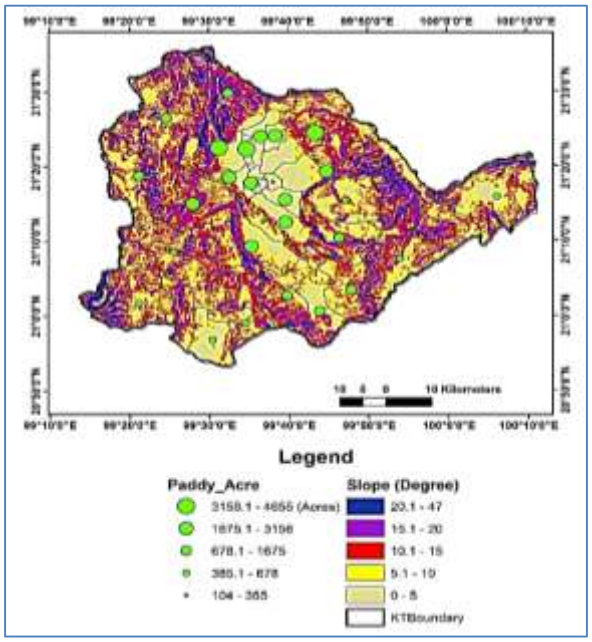

Figure 8. Relationship between Monsoon Paddy Cultivated Land and Slope Degree

Source: Table 4 and DEM

For the slope gradient i.e., slope percent rise per one kilometer, most of the monsoon paddy cultivations are found slope gradient under 9 percent rise per one kilometer distance. The remaining areas i.e., gradient over 9.1 percent rise per kilometer are little or no paddy cultivated lands. (Figure 9)

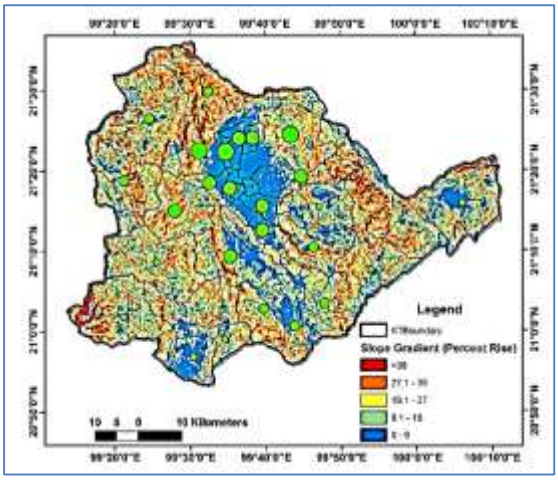

Figure 9. Relationship between Paddy Cultivated Land and Slope Gradient
Source: Table 4 and DEM

It is clearly seen that the monsoon paddy cultivations are related with water body or creeks of the study area. Most of the cultivated areas located near creeks or streams. (Figure 10)

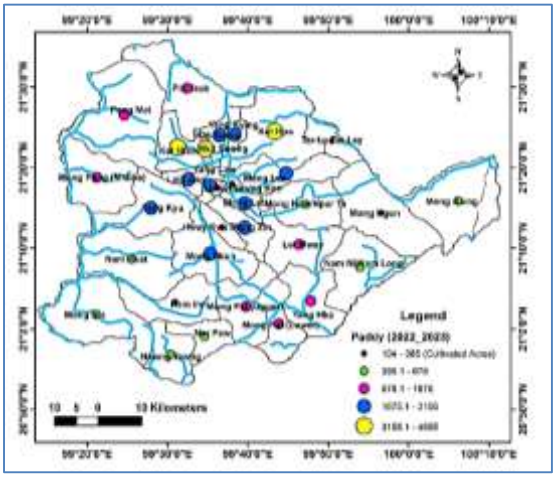

Figure 10. Relationship between Paddy Cultivated Land and Creeks
Source: Table 4 and DEM

Besides, most of the paddy cultivated lands located near the transportation roads. The remoteness areas has little paddy cultivation lands. (Figure 11)

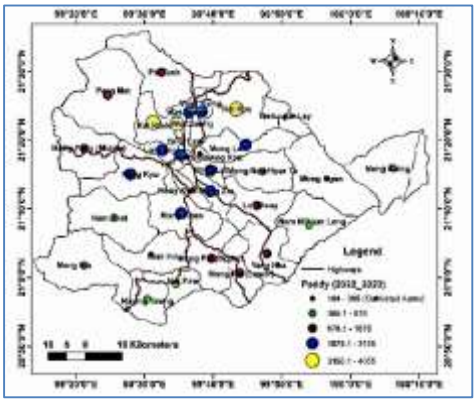

Figure 11. Relationship between Paddy Cultivated Land and Roads

Source: Table 4 and road map of Kyaing Tong

The soil types within Kyaing Tong Township is strongly relationship between topography, types of climate and vegetation cover as well as the soil units, properties and land use capability in those of the area.

The most prominent soil types in Kyaing Tong Township are Mountainous Red Brown Forest Soil (Cambisol-Chromic), Mountainous Brown Forest Soil (Cambisol-Histric) and Meadow and Meadow Alluvial Soil (Gleysol and Fluvison) and Red Earth and Yellow Earth (Acrisols). Mountainous Red Brown Soil can be found on the Shan Highlands at an elevation between 4,000 and 6,000 feet. Due to the practice of shifting cultivation, the area where the surface soils on the steep slopes have been eroded away. As such exposed soils are remained as the mountainous Red Brown Forest Soils.

Conclusion

The total area of Kyaing Tong Township is 378,371.8 hectares (934,977 acres). In 2022-2023 data, 8.57 percent or 32410.86 hectare (80089 acres) is used for cultivated Land, 13.43 percent or 50826.49 hectare (125595 acres) for cultivable virgin land, 17.25 percent or 65268.91 hectare (161283 acres) for forest land, 28.5 percent or107827.68 hectare (266448 acres) with unclassified forest and non- cultivated land amounted to 32.25 percent or 12237.81 heactare (301,562 acres) of Kyaing Tong Township area. According to the data, average land- man ratio for the whole township is about 0.08 hectare per person or 0.21 acre per person in 2022-2023.

Monsoon paddy is the dominating constituents in the first ranking crop combinations or monoculture, which covers all of the village tracts in township. In Kyaing Tong Township, of the total cultivated area of 32410.86 hectare (80089 acres), 19420.05 hectare (47988 acres) represent the monsoon paddy net sown area, i.e., about 60 per cent. In order of area covered, the most important crops are monsoon paddy, rubber, maize, corn, groundnut and soyabeans. (Phyu Thi Htet,Ma.(2019)) Crops occupying less than one per cent of the gross cultivated area have not been included as they occupy an insignificant area.

The suitability of a crop and cropping pattern may be judged on the basis of the following:

1. The crop should not accentuate certain diseases as a result of a fixed continuous rotation.
2. The crop should not exhaust on some specific plant nutrients from a particular depth of the soil.
3. The crop should be fertility building and soil improving.
4. The crop should fetch handsome return to the cultivator and should provide the farmer employment and income all the year round.

Moreover, the crop should ensure the optimum utilization of his resources, particularly inputs like irrigation water, chemical fertilizers, insecticides, pesticides, equipment, power and family labour. This research is useful for the local needs and regional development planning in Kyaing Tong Township.

Acknowledgements

In attempt to this research “Monsoon Paddy Cultivation in Kyaing Tong Township ", we are very grateful to Rector Dr. San San Mar, Kyaing Tong University, and Pro-rector, Dr. Mya Mya Khin for their permission for this research. The authors are highly grateful to the editors of Myanmar Academy of Arts and Science who give as permission to summit this research paper. The authors’ deepest gratitude goes to our colleagues and the participants who provide us grammar checked as well as thoughtful suggestions, careful assessments and valuable comments, concerning research paper.

References

Dayal Edison, (1984): “***Agricultural Productivity of India”***, A Spatial Analysis Annals of Association of American Geographer.

Jasbir Singh & S.S. Dhillon (2004): ***“Agriculture Geography”***, 3rd edition, Tata McGrewHill Publishing Company Limited, New Dehli, India.

Grigg, D. (1995): *“**An Introduction to Agricultural Geography*”** Rout Ledge, London and New York.

Priyadharshini, S. Dr. and S. Aruchamy, S. (2014): ***“Agricultural Regionalization Based on Cropping Pattern in Sweta Nadhi Basin, Tamil Nadu***” Indian Journal of Innovative Research Development.Vol.3.

Phyu Thi Htet,Ma.(2019): ***“A Geographical Analysis on Paddy Production of Kyaing Tong Township”*** unpublished, M.Res Thesis, Department of Geography, Meiktila University.

မြန်မာကျမ်းကိုးစာရင်း

ကျိုင်းတုံခရိုင် လူဝင်မှုကြီးကြပ်ရေးနှင့် အမျိုးသားမှတ်ပုံတင်ထုတ်ပေးရေးဦးစီးဌာန၊ လူဦးရေစာရင်းများ (၂၀၂၀)၊ ကျိုင်းတုံမြို့။

ကျိုင်းတုံမြို့နယ် အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာန၊ (၂၀၂၁)၊ ဒေသဆိုင်ရာ အချက်အလက်များ၊ ကျိုင်းတုံမြို့။