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Spatial Analysis on *Ya* Crops Cultivation in Myaing Township

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Abstract

As Myanmar is one of the agro-based countries, the major economic activities of Myaing Township depend largely on agricultural sector. Myaing Township is located in Pakokku District of Central Myanmar. Myaing is an old town since ancient time. This township is famous for Thanakha growing. So agriculture is the major economic activity. The main agricultural type of the study area is *Ya* cultivation and grown mostly *Ya* crop. The major controlling factors on *Ya* crop cultivation have changed since after 1988 when Myanmar started open market economic system. Before this time, *Ya* crop cultivation depended on physical factors, Now, socio-economic conditions play important role in *Ya* crop cultivation. Therefore, the researcher wants to make a research on *Ya* crops growing and collected the data and find the best result. To analyze the data the researcher calculates concentration "Index" and got the result. Eventually, the economic condition influencing the productivity of *Ya* crops has been described in detail. Therefore, the researcher wants to analyze on *Ya* cultivation and collect the data and find the best result.

Key words: *Ya* crop cultivation, concentration “Index”

Introduction

Agriculture sector is the engine for broad economic growth. Myanmar is an agro-based country and has been trying to become agro-based industrialized country predominantly since 1988. Compared to any other sectors, the growth of the agriculture productivity has been recognized as an important role in raising real incomes of the rural people and hence reducing their poverty. Agricultural development strategies would be critical for many countries to achieve the agricultural development. Since early 1990s, the government of Myanmar has adopted the market oriented economy.

The major cultivated crops in Myanmar are cereals, oil-seeds crops, pulses, industrial crops and others. The major agricultural types of Myanmar are ‘*Le’* (wetland cultivation), ‘*Ya’* (dry land cultivation), ‘*Kaing-kyun*’ cultivation (alluvial island in/near rivers) and Garden. As Myaing Township is one of the areas in the Dry Zone of Myanmar, '*Ya*' cultivation and *Ya* crops are the most prominent in agricultural sector. *Ya* crops are the most dominant in study area because low rainfall, high erosion rate and low nutrient content in the soils of the study area.

Among the Dry Zone townships of Magway Division, Myaing Township has the largest cultivated area and is the most potential area for agricultural expansion. In 2005, the total cultivated area in Myaing Township is about 278093 acres (112540.42 ha) and about 241853 acres (97874.59 ha) or 87% of the cultivated areas are under *Ya* cultivation.

Aims

The main aims of this study are to analyse and explain the spatial distribution pattern of '*Ya*' crop cultivation and to evaluate the forces leading to changing pattern of '*Ya*' crops in Myaing Township from a geographical point of view.

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Methodology

In this research, the spatial distribution of geographical study employs an analytical approach to *Ya* cultivation within Myaing Township. All data calculations applied in this research are based on some statistical analysis in geography.

According to crop concentration index method as described by Bhatia (1965), some statistical analysis and spatial analysis functions were used to evaluate the crop concentration pattern of the study area.

Sources of Data

Data and documents are obtained from the Land Records Department, Myaing Township Peace and Development Council, Myaing, Myanmar Agricultural Research Farm, Yangon Meteorology and Hydrology Department. Primary data are obtained from field survey records and interviews with some responsible persons.

Definition

Ya means “cultivation without supplement of artificial water sources”.

Location

Myaing Township is one of the 25 Townships of Magway Division and included in Pakokku district. It is situated in the north eastern part of Magway Division and about 27 miles (43.45 km) from Pakokku Town.

It lies between north latitudes 20°25' and 21°55' and longitudes 94°30' and 95°20' East longitudes.

It is bounded on the north by Salingyi and Pale Township, on the east by Yesagyo Township, on the south by Pakokku Township, and on the west by Pauk Township. The area of Myaing Township is 785.66 sq miles (2034.85 sq km). The shape of Myaing Township is compact.

It is composed of 3 wards, 81 village tracts and 331 villages (Figure 1).

Physiography

Physical features in this Township can be divided as follows (Win Swe, 1991);

1. The Western Hilly and Mountainous Region
2. The Central Undulating Plain and Alluvial Plain and
3. Eastern Shinmataung Hilly Region (Figure 2)

Climate

Myaing Township experiences Tropical Steppe Climate. Moreover, the Township is included in the Dry Zone of Myanmar, its experiences high daily temperature range and high evaporation and transpiration. The highest average temperature is 38.52°C in April and the lowest temperature is 14.07°C in January during 1986 to 2005. The average annual temperature is 22.2°C. Total annual rainfall is 25.76" (654 mm). Myaing Township has suitable climatic conditions for flourishing '*Ya*' cultivation (Figure 3, Figure 4).

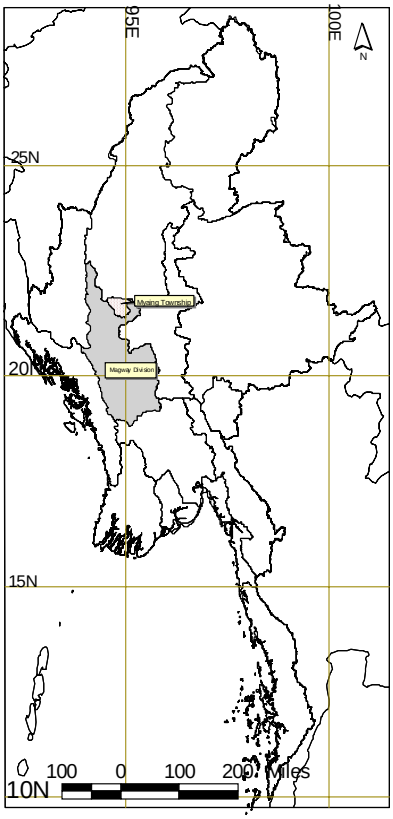


Figure 1. Location of Myaing Township

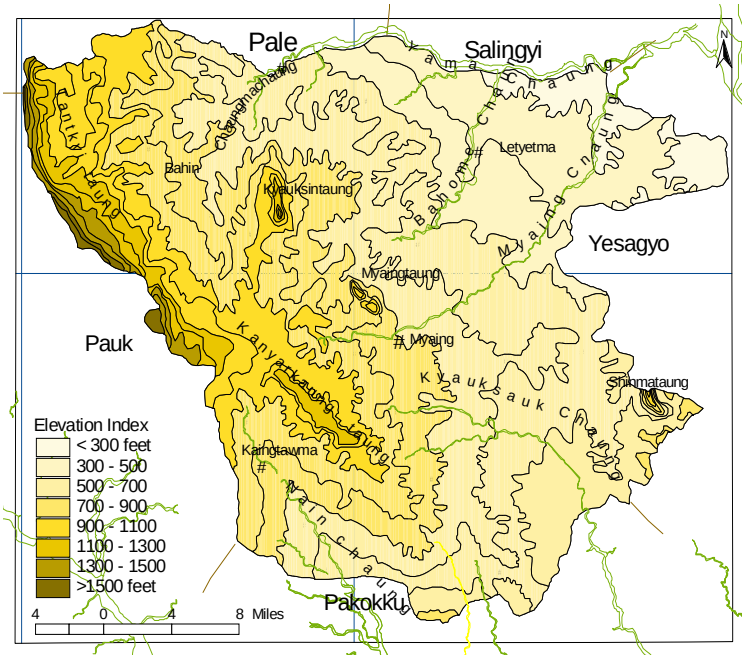
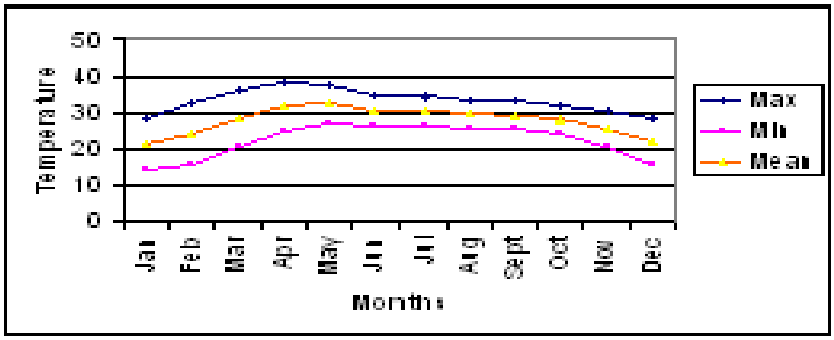


Figure 2. Physical features and drainage of Myaing Township
Source: Myanmar Agriculture Service, Myaing Township



Temperature	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Max	29.57	32.47	36.51	38.52	37.82	34.47	34.33	33.65	33.24	32.16	30.69	28.52
Min	14.07	15.75	20.39	24.83	26.76	26.31	26.17	25.88	25.46	23.99	20.31	15.88
Mean	21.32	24.11	28.45	31.68	32.29	30.39	30.25	29.77	29.35	28.07	25.50	22.20

Figure 3. Temperature of Nyaung Oo Station in Degree Celsius (1986-2005)
Source: Meteorology and Hydrology Department, Yangon

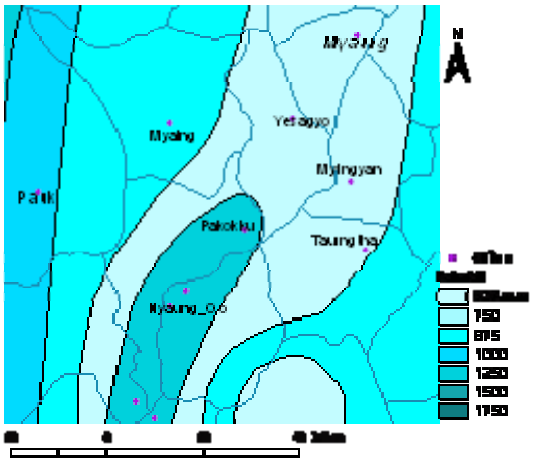


Figure 4. Annual rainfall of some Dry Zone townships
Source: Calculated based on Data from Meteorology and Hydrology Department, Yangon

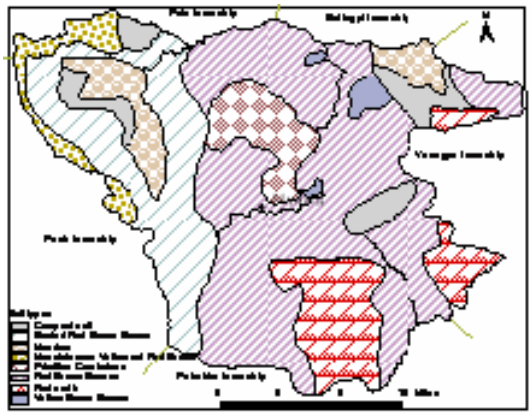


Figure 5. Soil Types of Myaing Township
Source: Landuse Bureau, Yangon

Geology

There are 8 groups of geological succession, which are as follow (Bender, 1983);

	Rock Type	Geological Age
1.	Recent Alluvium	Pleistocene
2.	Irrawaddy Formation	Middle Pliocene
3.	Kyaukkok Formation	Middle Miocene
4.	Padaung Formation	Middle Oligocene
5.	Shwezetaw Formation	Lower Oligocene
6.	Yaw Formation	Middle Oligocene
7.	Pondaung Formation	Upper Eocene Epoch
8.	Igneous Rocks	Miocene

The types of soil can be divided as follow; Figure (5)

1. Meadow soils
2. Dark compact savanna soils
3. Red brown savanna soils
4. Yellow brown savanna soils
5. Red brown crushed stone soils
6. Red brown eroded savanna soils
7. Turfy primitive soils
8. Primitive crushed stone soils
9. Mountainous yellow brown soils and red brown soils

Natural vegetation

- Dry upper mixed deciduous
- Dry forest and scrub

Social Bases

Total population and its growth

Generally, Myaing Township is located in the Dry Zone area with scanty rainfall and has less productivity agriculture land. The network of transportation is also poor and most of the township area is less suitable for cultivation. Thus the township is included in the sparse populated area. In 2005, the total population of Myaing Township was 328042. Population growth of Myaing Township increasing rate is 2.08 percent per year.

Distribution and density

The main economic activity of the township is based on the agriculture sector. Thus most population live in rural areas. In 2005 there lived a total of 328042, of which, 318925 persons or 97.2 % lived in the rural areas. Densely populated village tracts are generally associated with the major cultivated land of the study area (Figure 6).

Man-land ratio

The average man-land ratio is 1.74 acre (0.7 ha) per person. This is the highest man-land ratio in Magway District. This means, that Myaing Township has potential areas for agriculture expansion (Figure 7).

Agricultural Developments

Geographically, Myaing Township is located in the western part of the Central Dry Zone Area of Myanmar which has low rainfall and high temperature with less productivity land for agriculture (Hla Tun Aung, 2003). The rolling land and severe erosional agents are predominant and thus agriculture in the study area is difficult to develop. Hence, at present,

only 55 percent of the total township area is under agriculture. A greater proportion is *Ya* land (87% of total cultivated land). *Le* land accounts for 12% and Garden land 1% (Table 1).

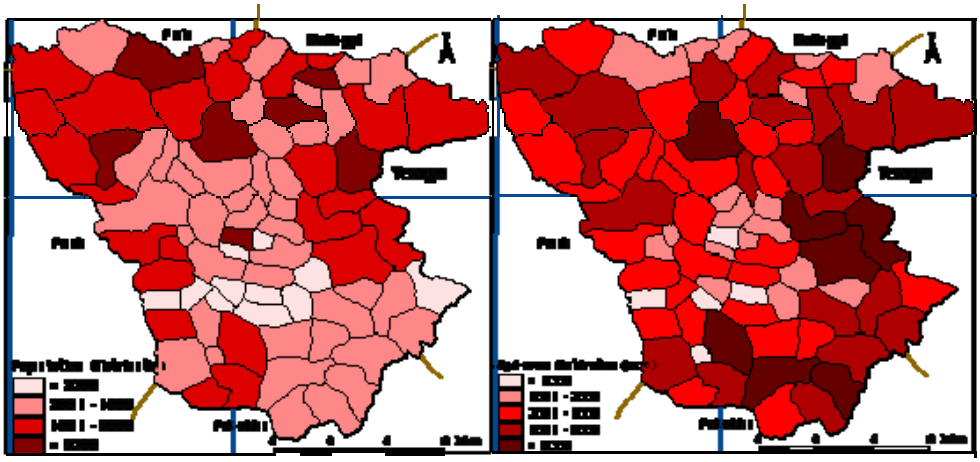


Figure 6. Comparison of population distribution with agriculture area

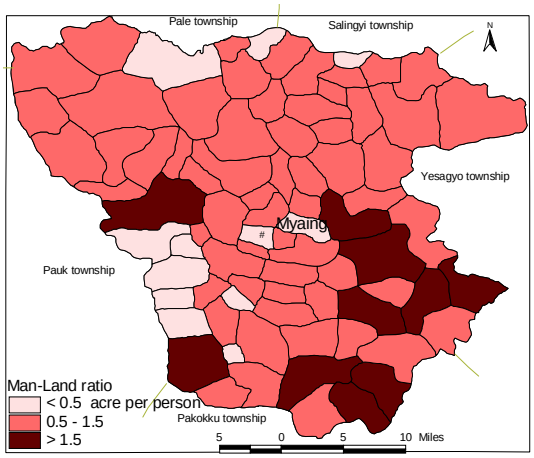


Figure 7. Man-land ratio of Myaing Township (2005)

General Landuse

The principal occupation of the people in Myaing Township is agriculture. The extent of landuse for agriculture is varied from place to place and from time to time with the differing geographical features leading to the differences in crop yield.

The usability of land depends on geographic features such as slope, erosion, drainage and soils. The general landuse of Myaing Township can be divided as follows:

1. Cultivated land
2. Culturable wasteland
3. Forest land
4. Transportational land
5. Water body areas
6. Settlement areas and
7. Others

From 1994-95 to 2004-2005, the average cultivated land occupies about 282603 acres (114365.55 ha) or 55% of the total township area (Table 1).

From 1994-95 to 2004-2005, the culturable wasteland represented 11% of township area. The average culturable wasteland is about 64234 acres (25994.62 ha) and it has been decreasing year by year.

Most of the culturable wasteland has been turned into other landuse types, particularly into agricultural land. Some culturable wasteland has been used as fuel wood plantation and settlement areas.

There were 26455 acres (10705.98 ha) of forest land in Myaing Township in 2005, representing 5.3 percent of total township area. Forest land lies in the western part of the township. The forest land area includes Tantkyi, Theinminkha, and Kyauksintaung (extended) reserved forest. Transformation of forest land to other landuse is the major type of landuse change in southwestern part of the township.

From 1994-95 to 2001-02, the total area of forest land was 4372 acres (1769.29 ha) and from 2002-03 to 2004-05, the forest land increased again due to the reforestation and the fuel wood plantation in degraded agricultural land of severe erosional areas of the western, southern and southwestern parts of the township. In 2004-05, total forest area was 26455 acres (10705.98 ha).

Table 1. General landuse in Myaing Township (ha) (1994/95-2004/05)

Year	Cultivated area	Culturable wasteland	Forest land	Others	Township total
1994-95	116347.7	29366.5	1769.3	55998.5	203485.6
1995-96	115327.1	28375.0	1769.3	58014.2	203485.6
1996-97	114862.1	27618.2	1769.3	59232.7	203485.6
1997-98	114709.1	27099.4	1769.3	59907.7	203485.6
1998-99	114490.2	26600.0	1769.3	60629.7	203485.6
1999-00	114760.1	25983.3	1769.3	60972.9	203485.6
2000-01	115639.9	25794.7	1769.3	60972.9	203485.6
2001-02	115968.1	24702.0	1769.3	61046.1	203485.6
2002-03	111360.8	24125.4	10706.0	57293.5	203485.6
2003-04	112014.3	23475.9	10706.0	57293.5	203485.6
2004-05	112540.4	22800.4	10706.0	57438.7	203485.6
Average	114365.6	25994.6	3865.6	58981.8	203485.6

Source: Land Record Department, Myaing Town (2005)

Transportation landuse also slightly increased in Myaing Township, as existing roads were upgraded and new gravel roads were constructed. The chief mode of transportation includes road and rail. Most of the roads have been upgraded by communal-self basis. For regional economic growth, the new and upgraded roads are essential infrastructure.

Out of the total township area of 502823 acres (203485.56 ha), there are 932 acres (377.17 ha) of town area, 7707 acres (3118.92 ha) of village settlement area, 8171 acres (3306.69 ha) of water covered area and unclassified area is 111369 acres (45069.50 ha).

Cultivated land

Agriculture is the major occupation of the people of Myaing Township. But the extent of land under cultivation is varied from place to place depending on features such as slopes, elevation, erosion, drainage, soil and precipitation. Especially soil, precipitation and water availability are more important in agricultural activities. Most of the cultivated lands are

found under 1000' elevation and in Red-brown savanna soils and Yellow-brown savanna soils areas.

According to Table 1, the cultivated area occupies more than 50 percent of the total township area. However, the total cultivated area decreased by the 855 acres (346 ha) in average. This decrease is due to the existence of cultivated areas on highly eroded area and these lands were changed into degraded forest areas and some into fuel wood plantation areas.

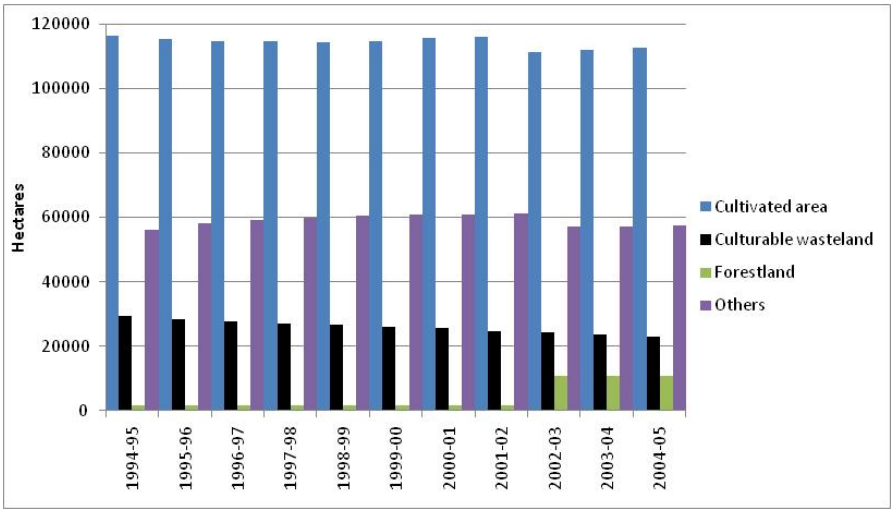


Figure 8. General Landuse of Myaing Township
Source: based on Table (1)

The major cultivated areas are found in eastern part of the township where the elevation is less than 800 feet, having suitable soil types. In that part, Alekan, Seiksin and Kyauntseik village tracts have more than 80% of cultivated areas.

The lesser cultivated areas are found in the western ranges areas. In this part, Htayaung, Thadut, Wedaung, Taungzone, Thetkekan and Kanyarkaung village tracts have least cultivated areas in Myaing Township. The Shinmadaung range on the eastern part of the township has also lesser cultivated areas.

Most of the cultivated areas are found in the eastern part of low lying areas especially along the Yamar chaung, Myaing Chaung, Bahome Chaung, Kyauksauk Chaung and Nain Chaung which have level low land with fertile soils. Nearly all these *chaungs* have water in the rainy season or after rain. But, these are partly support for cultivation especially for *Ya* crops.

Changes of cultivated land

Myaing Township is changed every year. According to Table (1) and Figure (8), the average cultivated areas from 1994-95 to 2004-05 is 282603 acres (114365.55 ha). Since 2002-03, the total cultivated area of Myaing Township has decreased. Some cultivated areas were changed into forest areas and some into unable-cultivated lands.

The natural condition of Myaing Township is restricted to maintain stable landuse and stable crop production. The productivity of cultivated land is negatively affected by soil erosion, cropping on soils of low fertility, low input use and environmental deterioration due to the highly climatic variable conditions and erosion. Therefore, the land potential for cultivation is become decreasing trend (Table 1 & Figure 8).

The obvious change in cultivated land can be seen in highland areas of the western and southern parts of the township. In this area, rapid soil erosion rate occurs due to natural conditions. Most of the agricultural potential areas in these parts have changed into unproductive land. Therefore, most of the cultivated areas have transformed into pasture, or bare land, these land are used for Tha-nat-khar plantation.

Type of Cultivation

In Myaing Township, there are four types of cultivation. Based on existing physical conditions, *Ya* cultivation is most suitable and distinctive type for Myaing Township.

Ya Cultivation

This is the most important type of cultivation in Myaing Township. In 2004-05, there were 241853 acres (97874.59 ha) of *Ya* land. This accounted for 86.97% of total cultivated area. *Ya* lands are distributed on the eastern, southern and northern lowland areas of red brown savanna, yellow brown savanna and eroded red brown savanna soils covered areas (Figure 9 and 10).

Le Cultivation

Le cultivation is the second most important type in Myaing Township. Most of the '*Le*' lands are found in the lowland area of the township and paddy is mostly grown. The successful of '*Le*' cultivation mainly depends on water available. Therefore, in some low annual rainfall years, the *Le* land grown secondary crops of corn, maize and sesame are grown.

Kaing and Garden Land

This is only small area in Myaing Township, mostly found along deposited areas of Yama chaung and other streams. In this type of land, onion and some garden crops are grown.

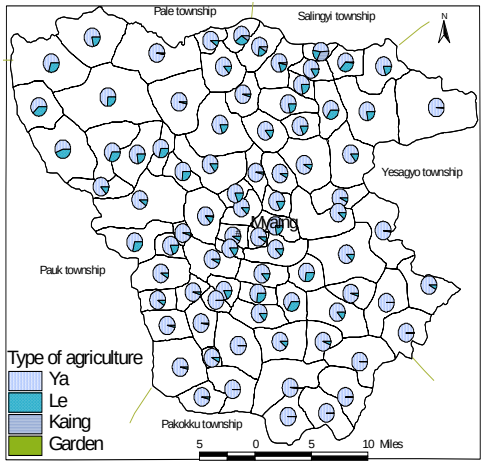


Figure 9. Distribution of type of cultivation in Myaing Township (2005)

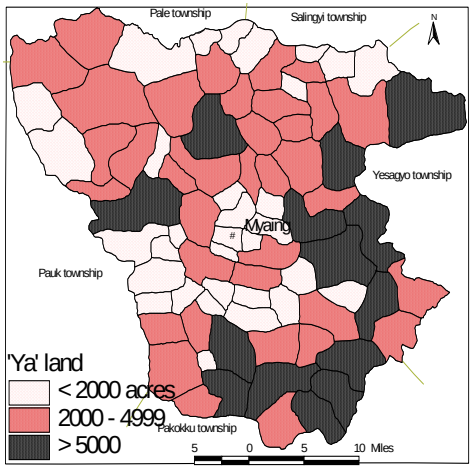


Figure 10. Distribution of 'Ya' land in Myaing Township (2005)

Source: Based on Table 1 and 2

Table 2. Type of cultivation in Myaing Township

Year	Total cultivated area(ha)	*Ya* Land	*Le* Land	*Kaing_Kyun* Land	Garden Land
1999-00	115639.91	100723.98	14433.14	474.29	8.5
2004-05	112540.42	97874.59	14183.04	474.29	8.5

Source : Myanma Agriculture Service, Myaing Township(2005).

_Ya_ crops cultivation

Since Myaing Township is located in the Dry Zone area of Myanmar and received low rainfall and high temperature, *Ya* crops cultivation is the most suitable type of cultivation. In Myaing Township, there are several type of *Ya* crops that can be grown according to the landform, soils and water availability.

The cultivated crops in *Ya* lands can be grouped as follow:

1. Pulses
2. Oilseed crops
3. Cereals
4. Industrial crops
5. Vegetable and Others (Table 3)

Table 3. Total Cultivated of Some *Ya* Crop of Myaing Township

No	Crop	Year	
		1999-00	2004-05
1	Sesamum	39235.14	44360.90
2	Groundnut	8321.97	9714.09
3	Sunflower	5269.82	10191.21
4	Maize	22650.29	31371.28
5	Gram (Kalape)	2834.02	3388.03
6	Green gram (Pedisein)	24236.66	26836.37
7	Lalab bean (Pegyi)	2273.93	1707.78
8	Pigeon pea (Pesingone)	26040.75	37217.38

Spatial Analysis

Analysis on _Ya_ crop concentration

Bhatia's crop concentration method was used to represent the changing pattern of *Ya* crop cultivation. This method is based on the 'Index', obtained by dividing the ratio of sown acreage to total sown acreage of each crop type with the ratio of sown acreage to total sown acreage of that crop in the township.

Concentration 'Index' of crop 'a' = (c/v) / (**C/V**)

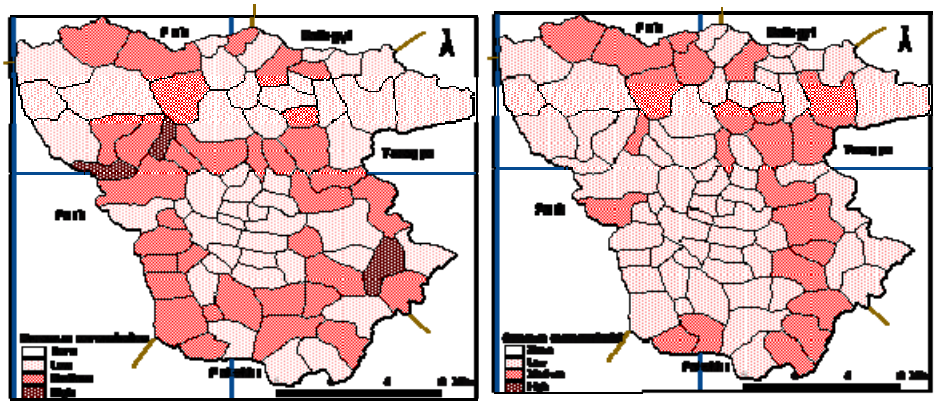
Where, c = sown area of crop 'a' in certain village
v = sown area of all crops in certain village
C = total sown areas of crop 'a' in the township
V = total sown areas of all crops in the township.

The higher value of index indicates the more concentration of certain crop in that village.

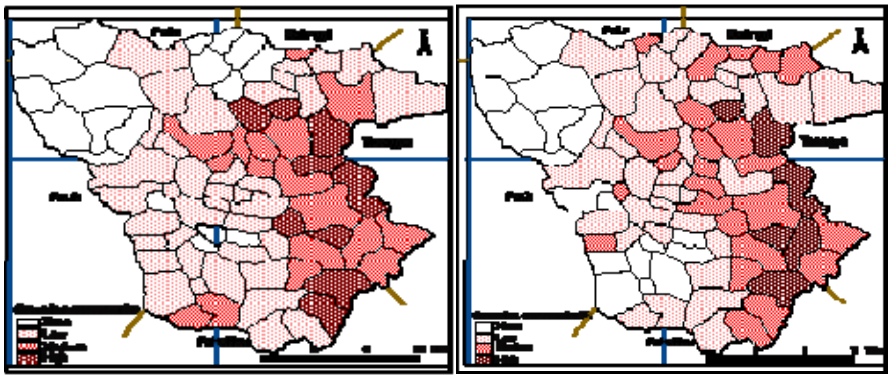
This research presents the calculated value for eight leading '*Ya*' crops including Sesamum, groundnut, sunflower, maize, and pulses of *Kalepe, Pedisein, Pesingone* and *Pegyi* in 1999-00 and 2004-05. Table 4 presented the index of sown area corresponding to the high, medium and low degree of concentration for different crops. Based on this index class it was created the concentration Figure for each crop. The results are shown in Figures 11.a, b, c, d, e, f, g, h, i, j, k, l, m, n, o and p.

Figure 11.a,b represent sesamum which is grown in all villages and the concentration values are equally distributed. This means that sesamum is the most important '*Ya*' crop for every village in Myaing Township. In 1999-00, the total sesamum cultivated area in Myaing Township was 96952 acres (39235.14 ha) (Table 5.1). In that year, the concentration index was more equally distributed over Myaing Township. However, in 2004-05, the total sesamum cultivated area increased into 109618 acres (44360.9 ha). Suwin, Gyokekone, and Magyisu village tracts were more intense cultivated than the other village tracts (Figure 11.a & 11.b).

Figure (11.c) (11.d) reveals the concentration pattern of groundnut and it is more related with the soil types of the township. In the northwestern part of the township, where the eroded soil and mountainous area are dominant, groundnut is least grown and the area under groundnut is nil in 17 village tracts. It can be seen that the groundnut concentrated areas were closely associated with alluvial soil areas and riverine area of Kyaukkan, Phyathi, Letyetma, Kyikan, Sabe and Magyisu village tracts **(**Figure 11.c) and (11.d).

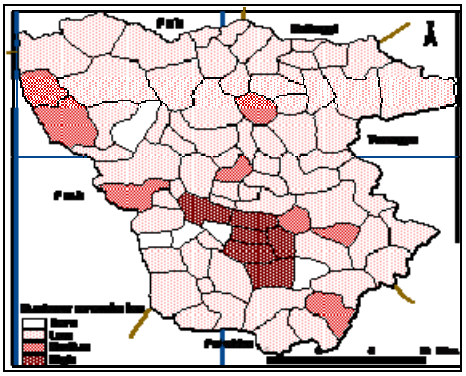


a. Sesamum 1999-00 b. Sesamum 2004-05

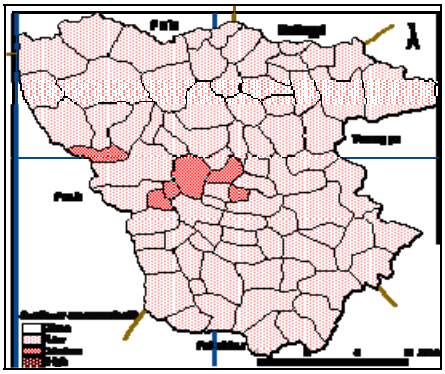


c. Groundnut 1999-00 d. Groundnut 2004-05

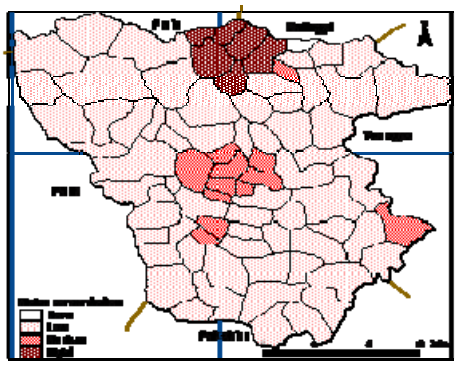
Figure 11 The distribution of crops concentration index (1999-00 and 2004-05)



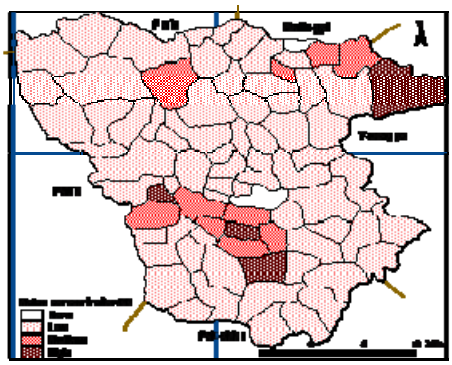
e. Sunflower 1999-00



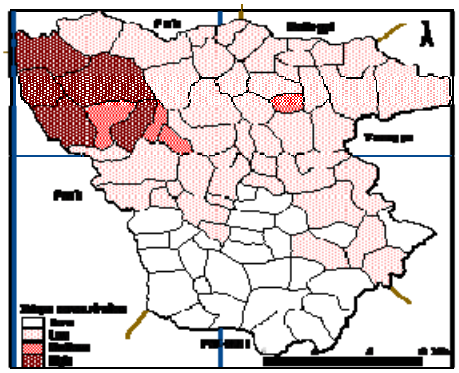
f. Sunflower 2004-05



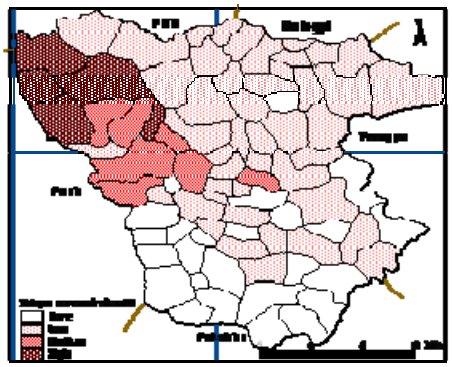
g. Maize 1999-00



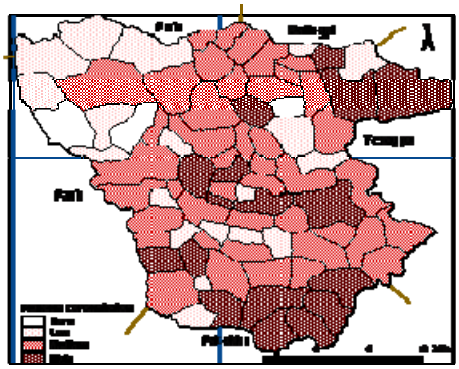
h. Maize 2004-05



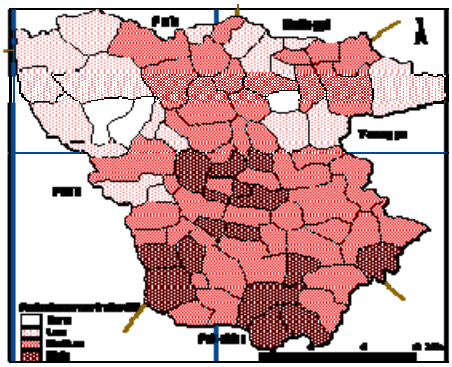
i. Gram 1999-00



j. Gram 2004-05

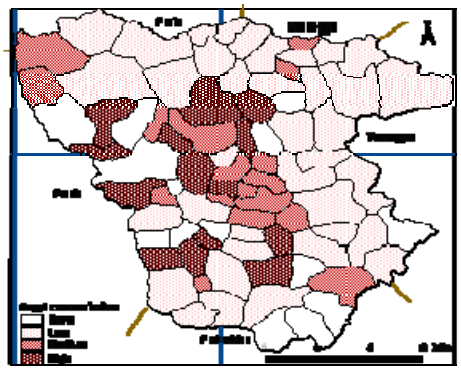


k. Green gram 1999-00

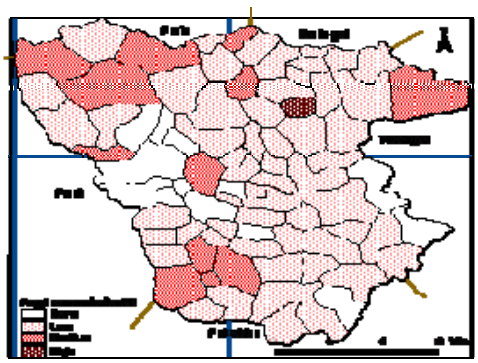


l. Green gram 2004-05

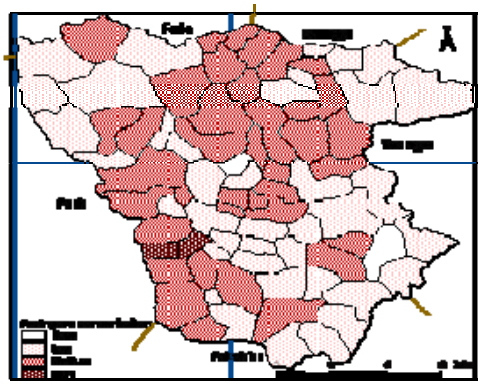
Figure 11 The distribution of crops concentration index (1999-00 and 2004-05)



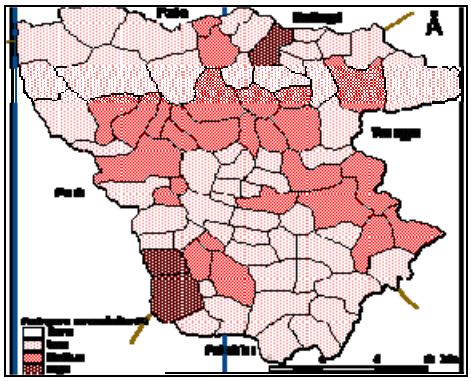
m. Lalab bean 1999-00



n. Lalab bean 2004-05



o. Pigeon pea 1999-00



p. Pigeon pea 2004-05

Figure 11 The distribution of crops concentration index (1999-00 and 2004-05)

Figure 11.e, 11.f show the sunflower concentration pattern, which is also related to the physical condition. Some areas have the concentration value of about 1.5 and some have low index as zero. In comparison of sunflower concentration and maize concentration areas, the high concentration of maize is directly linked with the least groundnut concentration area. The maize is the pure *Ya* crop and it is more resistant to dry condition than groundnut and other *Ya* crops. Myotin, Thitkyitaw, Thinbaungkan, Sinswe, Wedaung, Suwin and Inyoung village tracts were intense maize cultivated area in Myaing Township (Figure 11.g & 11.h).

Pulses are the standard crop of the Dry Zone area and it is grown in every village more or less. But the interest in the pulses type is different from village to village. The concentration values reveal the interest and the spatial variation of pulses type for Myaing Township.

Figure 11.i, 11.j show the concentration value of Kalepe (Gram/Chick pea) in Myaing Township. Among the different pulses type, Kalepe is the most resistant to drought and low fertility condition. Thus, most of the high concentration areas of Kalepe are found in the higher area of western part of the township and some low fertility soil areas. Thidone, Sinswe, Wedaung, Thadut, Bahim, Seikche and Thinma village tracts are highest Kalape concentrated areas of Myaing Township.

From agro-economic point of view, Pedisein is a popular crop among the pulses. In 1999-00, all village tracts especially northern, eastern and southeastern village tracts grew Pedisein as a major cash crop. In 2004-05, except three, Wedaung, Minthakya and Taungbo, all village tracts more or less grew Pedisein. The cultivated area of Pedisein has increased yearly. In Figure 11.k and 11.l the distribution of Pedisein concentration index is presented. Most of the eastern and south eastern part of the township grew Pedisein.

In other part of the township, Pegyi and Pesingone are grown as supplementary crops. The most cultivated area of these crops were Aima, Pebinteik, Obo, Bongyikan, Bantbo, Kaingtawma, Ywatanshe, Hninzikan and Myotin village tracts (Figure 11.m , n and 11.o, p).

Table 4. Concentration Index of eight selected crops in Myaing Township

No	Crops	Low concentration	Medium concentration	High concentration
1	Sesamum	0.01 - 1	1.01 – 2	2.01 – 3
2	Groundnut	0.01 - 1	1.01 – 2	2.01 - 3.7
3	Sunflower	0.01 - 2	2.01 – 5	5.01 – 10
4	Maize	0.01 - 1.6	1.61 - 2.6	2.61 – 4
5	Kalape	0.01 - 2	2.01 – 4	4.01 – 8
6	Pedisein	0.01 - 0.5	0.51 - 1.5	1.51 – 3
7	Pegyi	0.01 - 2	2.01 – 5	5.01 – 7
8	Pesingone	0.01 - 1	1.01 – 2	2.01 – 4

Driving Forces and Changing Pattern

Crop concentration study is useful in the analysis of cropping patterns and can be applicable into analyzing various other agricultural elements of climate, soil fertility, water availability and so on. Based on this concentration value, each crop can evaluate the changing pattern of particular crop with time and space and the level of interest in the proportion of particular crop.

Generally, all crops focus on the crop concentration pattern .Thus the concentration pattern of groundnut is more related with the distribution of soil and availability of water. Moreover, the socio-economic factors determined when the crops were chosen and the cultivators intend to grow based on their affordability and inputs.

Figure 11.a to 11.p are the central output of this research work. These are based on the GIS work and Spatial Analysis function. Based on the above figures, researchers can easily compare the distribution pattern of different crops on the same region or the same crop on different regions. This research work has been conducted with the best effort to create the spatial structure of *Ya* crops over the study area.

Finding and Suggestion

This research was based on the comparison of the result figures of spatial analysis. For the development of agriculture sector in Myaing Township, the variables of net sown areas, double cropping areas, crop intensity conditions, areas under commercial crops, population density, literacy rate, and access to technological knowledge are the major factors. The number of modern implements is very weak, indicating negative relation. The correlation between levels of agriculture development and fertilizer consumption reveals that, there was strong positive relation. But, the price of fertilizers has increased yearly; the farmers could not use those fertilizers to their farms.

The guidance of Myanmar Agriculture Service is important for the development of agriculture sector. The local farmers need training in management of soil and the inputs such as fertilizers, pesticides, High Yield Varieties seeds should be distributed to the farmers. If Myanmar Agriculture Service takes care of this aspect, the crop productivity will be increased. Electricity and transportation facilities should be made available by the local authorities.

Most of the farmers do not understand how to use the modern technology and implements for agricultural development. The farmers need sufficient amount of loan money by the MADB (Myanmar Agricultural Development Bank).

The total population of the study area was 328042 in 2005 with an average annual growth rate of 2.01% so that annual demand for food is increasing accordingly as well. To meet such increasing food demand, the regional authorities are exerting all-out efforts in all sectors, including the agricultural sector. But most of the potential land resources are physiographically less suitable

for annual crops and cannot grow every year. There have a considerable amount of arable land but, most of the potential areas are steadily changing into less and lesser potential conditions due to the lack of improved land conservation system. Conservation can only be successful if it is carried out with the full support of the local farmers. The indiscriminate removal of the natural vegetation by the shifting cultivation and over cutting for fuel need of rural areas leads to erosion which is most serious at the fall of the monsoon rains on bare soils. To reduce environmental degradation, and to develop sustainable agriculture in study area, the local people should cooperate with the authority concerned of the Forest Department and the Agriculture Department.

Conclusion

Myaing Township is located within Dry Zone area. It receives low rainfall and high temperature. The success of cultivation depends on natural precipitation. Because, irrigation water system is insufficient yet, *Ya* crops cultivation is major cultivation type in Myaing Township. There are several types of *Ya* crops that can be grown according to the landform, soils and water availability. Maize, sesamum, groundnut and pulses are the major types of crops in the study area.

Bhatia's crop concentration index method was used to calculate the relative strength of different crops within in Myaing Township. In this research, the areal concentration of individual crops was studied. Two units of measurement used to determine the concentration of crops are (1) areas under certain crops and (2) total sown areas.

Eight leading *Ya* crops of Myaing Township were investigated and Figureped. As shown in Table 5.3, maize, sesamum, groundnut and pulses are major cultivated crops of the study area. Among pulses, Pesingone and Pedisein are the mostly cultivated crops. The total cultivated areas of these crops were increased yearly.

The sown acreage of *Ya* crop varies from year to year. The sesamum cultivated area varies from one village tract to another. Thidone, Chaungsone, Linkataw, Nyaungywa, Magyisu, Wetkya and Hnawbin village tract are largest sown areas of Myaing Township.

Groundnut cultivated areas are also different from place to place. Dahatchauk, Hnawbin, Monhnyin, Letsekan, Kyikan, Shwelinswe, Kuntaw village tract are largest groundnut cultivated areas. The cultivated area of pulses are different form place to place and also different in interest of pulses type. It is easily analysed in (Figure 11.i to 11.p).

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