A Geographical Study on Sesame Cultivation of Meiktila Township

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Abstract

This paper emphasizes a geographical analysis of sesame cultivation in Meiktila Township. The main aim is to investigate the factors that influence the sesame cultivation and production of the study area. In order to trace the relationship between sesame cultivation and other determinant factors, Sesame Productivity Index (SPI), Linear Regression Method and GIS based overlaying method are used in this paper. As a result the spatial variation and temporal changes of sesame cultivation and production are strongly related to physical and human factors of the study area.

Key words: Linear Regression, Overlaying Method, Productivity Index, Sesame, Spatial Variation, Temporal Changes

Introduction

Like many other regions of Myanmar, Meiktila Township has originated its development from agriculture sector as a base. Thus, agriculture must be regarded as a primary economic activity of the township. As sesame is a first priority crop, sesame cultivation plays an important role in the agriculture of Meiktila Townnship. In this paper, sesame cultivation of Meiktila Township is analyzed from a geographical point of view.

Sesame is a common name for a genus, containing about 15 species of herbaceous plants native to Africa and Asia, applied especially to one of its species that is widely cultivated for its seeds. The oil extracted from sesame seeds is used in cooking as salad oil and in making margarine.

Sesame plant thrives well in the regions with annual mean temperature of between 77° F and 80° F, and annual rainfall of between 20 to 30 inches. Loam, Sandy Loam and Meadow Alluvial soils are suitable for sesame cultivation. Moreover the relief condition should be well drained. The rolling topography of Meiktila Township is suitable for sesame cultivation because sesame does not like the water logged condition.

Sesame is grown as "*Hnanlyin*" and "*Hnangyi*". "*Hnanlyin*" is cultivated in both pre-monsoon and monsoon seasons. They have short life span with an average of 75-100 days and hence they are called "*Hnanlyin*". The chief varieties of "Hnan lyin" grown in Meiktila Township are "Hnanni 25-160", "Sinyadana", "Magwe 2-21", "Boathmwe" and "Maithila". "*Hnangyi*" is not grown in Meiktila Township due to its long life span and its less income per acre.

Generally, cultivated crops of Meiktila Township can be classified into five types: cereal crop, oilseed crop, industrial raw material crops, pulses and other vegetables. The most important oilseed crops are esamum, groundnut and sunflower and the sesame ranks first in the sown acreage. Among them, the sesame crops were observed on the spatial and temporal variation.

Aim and Objectives

The main aim of this paper is to investigate the factors effecting the sesame cultivation and production of Meiktila Township.The objectives are-

- to study the geographical bases that effect the spatial variation and temporal changes of sesame cultivation and production
- to find out which are the most effective factors governing the spatio-temporal variation of sesame cultivation and production,
- to suggest some measures that can lead to potential development of sesame cultivation in the agricultural sector of Meiktila Township.

The Study Area

Meiktila Township lies in central portion of Mandalay Region and is located between 20° 39' 15" North Latitude and 21° 00' North Latitude, and between 95° 30' 40" East Longitude and 96° 00' 55" East Longitude. It has an area of 304,230.4 acres (475.58 square miles) and is composed of 14 Wards and 58 village tracts. Meiktila Township the most prominent areas in sesame cultivation. So, the area of study were choice to study and find out of sesame cultivation.

Data and Methods

Data used in this research were collected from both primary and secondary sources. Primary data are collected by doing field observation and interviewing with local farmers. Secondary data, topographic maps, reports and recorded photos, climatic datas were collected for the respective department.

Analytical works are mainly based on quantitative methods. Sesame Productivity Index (SPI) is used to study the sesame production and Linear Regression is applied to analyze the relationship between rainfall and sesame production while GIS based Overlay Method is used to trace the factors influencing the sesame cultivation and production of the study area.

Research Problem

Based on the physical factors, effort of farmers, types of agriculture practiced, utilization of agricultural technology, varieties of sesame seeds grown, knowledge and experience of farmers, the cultivation and production of sesame varried from place to place as well as changed from time to time.

It is essential to understand the factors that cause the spatial variations and temporal changes of sesame cultivation. "Which factors influence the spatial variation and temporal changes of sesame cultivation and production in the study area?" therefore is the research question of this paper.

Geographical Bases of Meiktila Township

Although Meiktila Township lies in the Central Basin of Myanmar, it is not a totally flat land. The western part of it is more undulating and is higher in elevation than the east. General elevation of Meiktila Township is between 600 feet (200 metres) and 900 feet (300 metres). Most of the streams are intermittent and the undulating features of the terrain render the good drainage system for the township. The distinctive drainage systems of Meiktila Township are Mondaing Chaung, Kanni Chaung and Chaunggauk Chaung while significant lakes are Meiktila Lake, Mondaing Dam and Chaunggauk Dam and Shanmange Dam. Meiktila Lake is a main source of water supply including irrigated water.

During the 40-year period from 1980 to 2019, monthly mean temperature was 81.09° F and average annual precipitation was 31.86 inches. As Meiktila Township experiences high temperature and low annual rainfall, it generally suffers from Tropical Steppe Type of Climate (***BSh***).

The major soil types found in Meiktila Township are (1) Alluvial Soil, (2) Meadow and Meadow Alluvial Soil, (3) Swampy Meadow Soil, (4) Dark Compact Savanna Soil, (5) Red Brown Savanna Soil and (6) Primitive Crushed Stone Soil.

Human concentrations have been on agriculture and agriculture also concentrates on people. According to 2014 Census, total population of Meiktila Township was 309,663 persons and it increased to 331,474 persons in 2019 with an annual growth rate of 1.37. Of the total population, 36 % were urban population and 64 % were rural population. Population density was 697 persons per square mile and about 42.8 % of workforces engaged in agricultural sector.

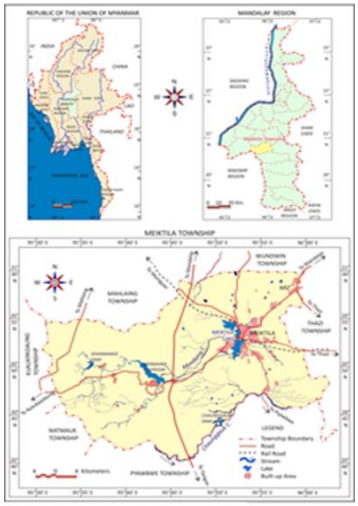


Figure 1: Location of Meiktila Township
Source: UTM Map No. 2095-09-2095-10, 2095-13,2095-14,2096-01 and 2195-16

Results and Discussion

Sesame Productivity

Sesame is a major oilseed crop of Meiktila Township and 31 % of the gross cropped areas are occupied by sesame cultivated areas. The study of sesame productivity is essential for the economy of study area because sesame is one of the most important cash crops. The understanding of the existing level of crop productivity is essential for better planning management and development of the any agricultural region.

Various scholars have developed the different methods of the measurement of crop productivity. Enyedi (1964) applied new method of crop productivity. He calculated an index of productivity to determine the levels of crop productivity.

The data derived from Department of Agricultural Land Management and Statistics in Meiktila Township have been utilized to obtain sesame productivity for every village tract. In analyzing, modified Enyedi's method was chosen to compute sesame productivity index for every village tract of the study area due to its accuracy. It is 1964. The formula of sesame productivity index is as follows.

$$\text{SPI} = \frac{Y/Yn}{T/Tn} \times 100$$

Where SPI = Sesame Productivity Index,
Y = Production of the sesame in the unit area (village tract),
Yn = Production of sesame in entire township,
T = Production of all crops in a unit area (village tract), and
Tn = Production of all crops in entire township.

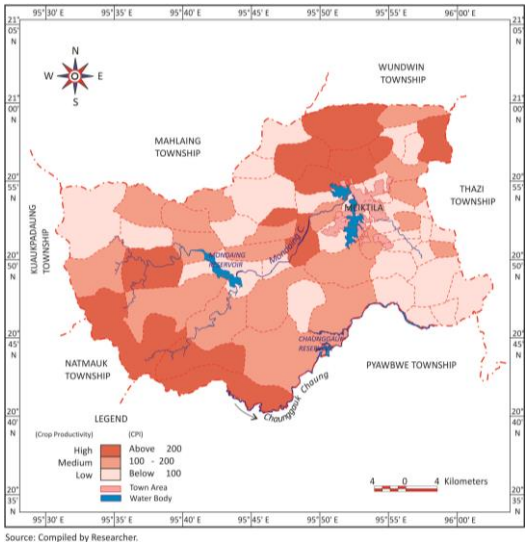
By using the formula, the sesame productivity indices were calculated for each village tract of Meiktila Township for the agricultural year 2018-2019. The calculated values showed that the highest productivity of sesame was recorded in Shamange village tract was the SPI of 359.5 and the lowest

productivity of sesame was seen in Kantha village tract was the SPI of 12.2.

Based on indices, the village tracts were demarcated as the high sesame productivity areas (SPI above 200), the medium sesame productivity areas (SPI between 100 and 200), and the low sesame productivity areas (SPI below 100).

The high sesame productivity areas were seen in 12 village tracts namely Shammange, Tabyaw, Yeway, Mazaligon, Kandaung, Shwepandaing, Kyaukbyugon, Kywetalin, Nyaungbinsho, Khinde, Nyaungzauk and Inn. The medium sesame productivity areas were recorded in 24 village tracts: Myaukhle, Magyigon, Thayetbin, Mondaing, Yegyo, Ayadaw, Leindaw, Galongon, Seaung, Mwe, Tawma, Kangyi, Gweaing, Wayon, Tamongan, Hlebwe, Myingan, Nyaunggaing, Kwetnge, Ohndon, Mauklauk, Ainggyile, Zayatgon and Shawphyugan. The low sesame productivity areas were recorded in 24 village tracts namely Nyaungmyint, Khinlu, Thigon, Yondaw, Kyaukbu, Magyisu, Shwesitthi, Kokkogon, Nyaunggon, Kywegan, Zaunggyangon, Kyaungywa, Kanni, Shante, Myar, Kaphyu, Satpyargyin, Aleywa, Pyintha, Nyaunggan, Thibingon, Thanbo and Kantha.

In order to predict the future prospect of sesame cultivation in the study area, one should understand the effects of physical and human factors because cultivation and production of sesame are governed by these factors.



Source: Compiled by Researcher.

Figure 2: Sesame Productivity of Meiktila Township (2018-2019)

Source: complied by Researcher

Influences of Rainfall Factors

Although climatic factors such as temperature and rainfall are important to sesame cultivation, as a township level, as they are equally distributed to the whole township and all village tracts receive the same chance in both rainfall and temperature, the effect of climate are not clear in determining the variation of sesame productivity from one place to another.

When the relationship between sesame production and annual rainfall for the 10-year period from 2009-2010 to 2018-2019 was studied by means of Linear Regression, the value of R^2 was 0.07. It means that there was no correlation between rainfall and sesame production. Annual variation of rainfall therefore is not important for sesame production.

Other things being equal, it can be assumed that the most effective influencing factors for the variation of sesame productivity may be topography and soil types. Therefore, relationship between these factors and sesame production is analyzed by using GIS based overlay methods.

The topographic map and sesame productivity map are overlaied. And soil map and sesame productivity map are also overlaid and then the results are calculated by the percentage algorithm.

Table (1) Rainfall and Sesame Production of Meiktila Township

Year	Rainfall (inches)	Production (Baskets)
2009-2010	36.1	458,914
2010-2011	33.55	140,383
2011-2012	40.95	232,697
2012-2013	20.87	92,976
2013-2014	39.52	211,104
2014-2015	24.12	201,724
2015-2016	39.41	179,883
2016-2017	29.05	467,775
2017-2018	35.47	470,576
2018-2019	30.86	227,969

Source: MHD and DALM&S, Meiktila

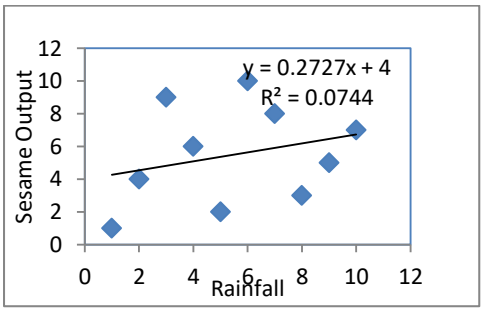


Figure 3: Correlation between Rainfall and Sesame Production

Source: Based on Table (3)

Influence of Elevation

In analyzing, about 58 % of the high sesame producing areas was found in the areas with an elevation between 200 and 300 metres, and 34 % was seen in the areas with an elevation of between 300 and 400 metres while only 8% were recorded in the areas with an elevation below 200 metres. Therefore, it can be said that the most suitable area of sesame production is the well drained areas with moderate elevation.

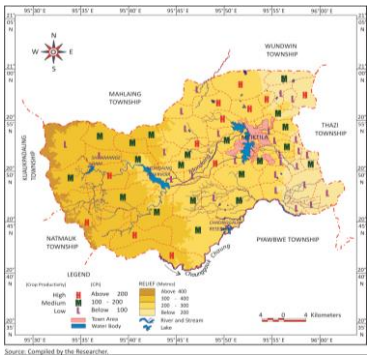


Figure 4: Relationship between Topography and Sesame Productivity

Source: complied by Researcher

Influence of Soil

In studying the relationship between sesame productivity and soil types, 33 % of the high sesame productivity areas occurred in the Red Brown Savanna Soils and 25 % seen in Alluvial Soils as well as in Meadow and Meadow Alluvial Soils. Therefore, it is found that Red Brown Savanna Soils are the most suitable soils and Alluvial Soils as well as Meadow and Meadow Alluvial Soils are the second most suitable soils for sesame production.

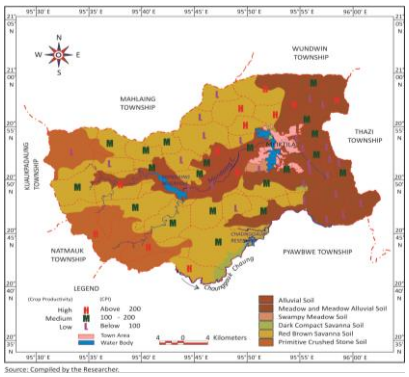


Figure 5: Relationship between Soil Types and Sesame Productivity

Source: complied by Researcher

Influences of Human Factors

Besides physical factors, **human factors** such as farmer's decision, agro-technology and government policy can determine the spatial variation of sesame cultivation and production of the township.

Farmer's decision is strongly related to market price. In order to approach qualitatively, 907 farmers in the township were randomly selected to interview. Of these 726 farmers (80%) desire to grown the most profitable cash crops. Based on the physical conditions and market price, farmers choose the most suitable crops for their profits. Consequently, sesame cultivation and production varied from one year to another. The farmer's decisions, therefore can affect the spatial variation and temporal changes of sesame cultivation and production of the township to some extent.

As local farmers use the traditional methods in sesame cultivation, the agro-technology is not developed in the study area. Therefore, a**gricultural technology** such as the measures concerning the agricultural mechanization, agro-practices and use of qualified seeds also influences the spatial variation and temporal changes of sesame cultivation.

Spatial Variation of Sesame Cultivation

Based on climatic factors, soil types, availability of agricultural water, market price, farmers' decisions, and accessibilities to agricultural infrastructures, sesame cultivation can vary from one place to another.

Sesame cultivation can be found in all village tracts of Meiktila Township. According to 1018-2019 data, total culticated area of sesame in Meiktila Township was 108,670 acres. The highest concentration of sesame was observed in Zayatgon village tract with 12,799 acres and the second highest concentration of sesame was seen in Nyaungzauk village tract with 5,477 acres while the lowest cultivated area of sesame was found in Magyigon village tract with 65 acres.

According to the cultivated area, the village tracts of Meiktila Township can be classified into 3 groups: the high cultivated area of sesame (over 2000 acres), the medium cultivated area of sesame (1000-2000 acres) and the low cultivated area of sesame (under 1000 acres).

The first group was concerned with 23 village tracts namely Zayatgon, Nyaungzauk, Thanbo, Yewe, Khinde, Gweaing, Nyaungbinsho, Yegyo, Inn, Myaukhle, Ohndon, Thayetbin, Mazaligon, Leindaw, Shanmange, Kwetnge, Wayon, Satpyargyin, Aleywa, Kwegan, Kandaung, Kanni and Tabyaw.

The second group included 12 village tracts: Kyaukbu, Thibingon, Mwe, Kyaukphyugon, Seaung, Kywetalin, Mondaing, Myar, Galon, Myingan, Ayardaw and Hlebwe.

The remaining 24 village tracts were related to the last group of the low cultivated area of sesame. These village tracts are Ainggyile, Shwepandaing, Nyaungmyint, Shwesitthi, Kantha, Mauklauk, Khinlu, Kaphyu, Kangyi, Kyaunywa, Thigon, Kokkogon, Tawma, Shawbyugan, Yondaw, Nyaunggon, Shande, Nyaunggan, Pyintha, Magyisu, Nyaunggaing, Zaungchangon, Htamongan and Magyigon.

Sesame Seed Pods

Sesame Cultivation in Meiktila Township

Plate 1: Sesame Seed Pods and Sesame Field

Spatial Variation of Sesame Production

Like cultivation, sesame production also varies from one village tract to another. According to 2018-2019 data, sesame production was the highest in Zayatgon village tract with 27,070 basets and the lowest in Magyigon village tract with 114 baskets. Yield per acre was the highest in Kaphyu village tract with 2.6 baskets and the lowest in Gweaing village tract with 1.7 baskets.

Based on sesame production, village tracts of Meiktila can be classified into 3 groups: (1) High production areas (Output over 4000 baskets), (2) Medium production areas (Output between 2000 and 4000 baskets) and (3) Low production areas (Output below 2000 baskets).

The high production areas included village tracts namely Zayatgon, Nyaungzauk, Thanbo, Yewe, Myaukhle, Khinde, Yecho, Ohndon and Thayetbin. The medium production areas were composed of 14 village tracts: Mazaligon, Nyaungbinshio, Leindaw, Inn, Shammange, Gweaing, Wayon, Kywegan, Kwetnge, Satpyargyin, Aleywa, Kanni, Kyaukhbu and Kandaung while remaining 36 village tracts were concerned with the low production areas.

Temporal Changes of Sesame Cultivation and Production

Sesame cultivation and production alsochang from year to year. According to table (2), in the year 2009-2010 to 2018-19, the average sown acres were 80,126 acres and the product of baskets were 268,400 baskets. During 10 year period, the sesame cultivation were increase about 77,562 acres to 108,670 acres and the product were decreased from 458,914 baskets to 227,969 baskets . Outputs of 3 years were higher than that of average while those of 7 years were lower than that of average. During the 10-year period, sesame cultivation sharply decreased in 2012-2013 and 2015-2016 and then, gradually increased in the last three years.

The highest sesame sown area was 108,670 acres in 2018-2019 and the lowest was 44718 acres in 2012-13. The highest yield per acre was 6.32 baskets in 2009-2010 and the least was 2 baskets in 2010-2011. Total output was the highest in 2017-2018 with 470,576 baskets and the lowest yield was 92,976 baskets in 2012-2013.

Sesame cultivation is one of the most important economic activities of the rural people in the study area. Major proportion of the rural population in the study area depends, wholly or partially, on the earnings from agriculture. Therefore, the development of agriculture is synonymous to the development of the study area. Nearly all areas of the township, sesame cultivation is not considered a real profession. This leads to a negative image of agriculture.

Table (2) Temporal Changes of Sesame Cultivation and Production

No.	Year	Sown Acre	Matured Acre	Yield per Acre (Baskets)	Output (Basket)
1	2009-2010	77,562	72,613	6.32	458,914
2	2010-2011	71,628	70,307	2.00	140,383
3	2011-2012	81,791	81,791	2.85	232,697
4	2012-2013	44,718	44,718	2.08	92,976
5	2013-2014	89,200	89,200	2.37	211,104
6	2014-2015	75,435	75,413	2.67	201,724
7	2015-2016	67,722	58,786	3.06	179,883
8	2016-2017	92,351	92,351	5.07	467,775
9	2017-2018	92,178	92,118	5.11	470,576
10	2018-2019	108,670	108,670	2.10	227,969

Source: Department of Agricultural Land Management and Statistics, Meiktila.

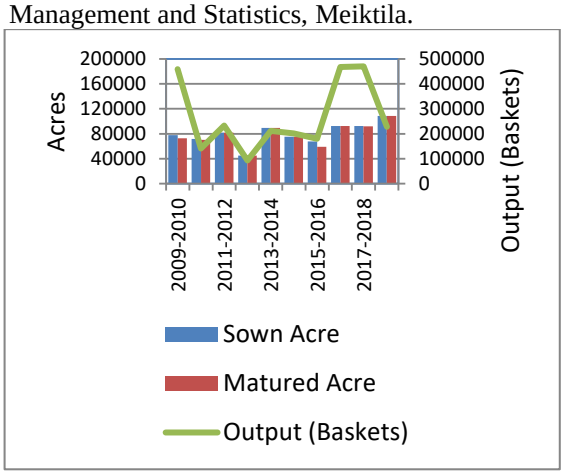


Figure 6: Temporal Changes of Sesame Cultivation and Production

Source: Based on Table (2)

Nevertheless, man is the master to the agriculture and creates it by his decision, ability, technological advancement, etc. Based on ideology of cultivators and encouragements of the authorities concerned, sesame cultivation of the study area can be promoted in the near future.

Conclusion

As a general rule, agriculture is the basic activity and one of the leading sectors of Meiktila's economy. Sesame is one of the leading crops of Meiktila Township and majority of population living in rural areas is also directly or indirectly linked with sesame cultivation for their livelihood.

In order to achieve the agricultural sector including sesame cultivation, the measures which should be undertaken by local authorities are as follows.

1. Undertaking the expansion of cultivated areas by reclaiming virgin land,
2. Encouragement of agricultural mechanization and adoption of improved agro-practices
3. Producing high yielding qualfied seeds suitable to the ecological conditions of specific regions.

4 Facilitating supply of various agricultural inputs by the State
5 Making arrangements for mutually beneficial cooperation between State organizations and local farmers,

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References

Bhatia, S.S. (1967): "**A New Approach to Measure Agricultural Efficiency in Uttar Pradesh**", Economics Geography Vol.43, pp.224-260

Carlaw, Kenneth I., and Richard G Lipsey (2003): **"Productivity, Technology and Economic Growth: What is the Relationship",** Journal of Economic Surveys, Vol. 17, No. 3.

Enyedi (1964): **Measurement of Crop Productivity**", perspectives in Agricultural Geography, Concept Publishing Company, p. 181

Food and Agriculture Organization of the United Nations (2006): **The Role of Agriculture and Rural Development in Revitalizing Abandoned/Depopulated Areas**, the supervision of the Policy Assistance Branch Regional Office for Europe, agri-leader@cec.eu.int.

Department of Population (2015): **The 2014 Myanmar Population and Housing Census**, Ministry of Immigration and Population, The Republic of the Union of Myanmar.