Geographical Assessment of Oil Seed Crops Production in Yenanchaung Township

May Wathone Zaw[1], Khaing Moe Aye[2], Su Phyo Paing[3]

Abstract

This study explores the geographical assessment of oil seed crop production in Yenanchaung Township, Magway Region, Myanmar, located in the country's central dry zone. Oil seed crops such as groundnut, sesame, and sunflower dominate local agriculture and play a critical role in sustaining rural livelihoods and contributing to the regional economy. The research focuses on identifying the physical and human geographical factors that shape oil seed cultivation, particularly climate variability, soil conditions, and topography. Employing a combination of field surveys, GIS-based spatial mapping, and statistical correlation analysis between climatic parameters and crop yields, the study reveals that erratic rainfall, high temperatures, and declining soil fertility significantly affect production patterns. On the human side, smallholder dependence, limited irrigation, and socio-economic constraints further challenge sustainability. Despite these difficulties, the study highlights opportunities for improvement through climate-smart agriculture, soil conservation techniques, irrigation development, and policy support. By adopting a place-based geographical approach, this research provides a comprehensive understanding of the spatial and environmental dynamics of oil seed crop production in Yenanchaung Township. The findings offer valuable insights for promoting sustainable agricultural practices in Myanmar's dry zone.

Keywords: Oil Seed Crops, Agricultural Geography, Climate Variability

Introduction

Agriculture in Myanmar's central dry zone is profoundly shaped by climatic variability, where rainfall patterns and temperature extremes dictate both cropping intensity and yields. Within this fragile ecological setting, oil seed crops particularly groundnut, sesame, and sunflower form the agricultural backbone of Yenanchaung Township in Magway Region. These crops are essential not only for household food security and edible oil production but also as a critical source of cash income for rural communities. The production of oil seed crops in Yenanchaung is inextricably linked to climate. Rainfall amount and distribution directly affect soil moisture availability, while prolonged dry spells and high evapotranspiration reduce yields. Temperature fluctuations influence crop growth cycles, flowering, and seed quality, making the relationship between production and climate both delicate and decisive. Recent decades have witnessed increasing climate variability, including erratic monsoon onset, shorter rainy seasons, and intensifying droughts, all of which exacerbate risks for smallholder farmer's dependent on rain-fed systems. From a geographical perspective, understanding this production climate nexus is vital. It requires examining how climatic conditions interact with local soils, topography, and farming practices to shape crop outcomes. Moreover, it highlights the adaptive strategies rural households employ from shifting cropping calendars to diversifying land use in response to environmental uncertainty.

Aim & Objectives

Understanding geographical factors shaping oil seed crop production in Yenanchaung Township and identifying sustainable strategies for resilient agriculture in Myanmar's dry zone.

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- To analyze the relationship between climatic variability (rainfall, temperature) and oil seed crop yields through statistical correlation methods.
- To assess the role of soil conditions, topography, and land use practices in shaping crop production patterns.

Material and Methods

This study employs a geographical approach that integrates qualitative and quantitative methods to examine oil seed crop production in Yenanchaung Township, Myanmar. It evaluates physical factors are climate, soil, and topography and human factors, including socio-economic conditions and farming practices. GIS and remote sensing techniques were applied to map cultivation patterns and analyze spatial variability. Primary data were gathered through structured field surveys, semi-structured interviews with farmers, and direct observations. Secondary data were sourced from official government reports, statistical yearbooks, meteorological records, and relevant literature. Combining these data and methods provides a rigorous framework to understand the environmental and socio-economic drivers of oil seed crop production in the township.

Study Area

Yenanchaung Township, situated in the central Dry Zone of Myanmar, forms part of Chauk District in Magway Region. It lies between 20°20′–20°35′ N and 94°50′–95°10′ E, covering 1,007.35 km² (100,738.80 hectares). The township has a compact, semi-square form and comprises 14 wards, 29 village tracts, and 145 villages. It is bounded by Chauk and Kyaukpadaung (Mandalay Region) in the north, Natmauk in the east, Magway in the south, and Minbu, Pwintbyu, and Salin in the west. The Ayeyarwady River constitutes its natural western boundary.

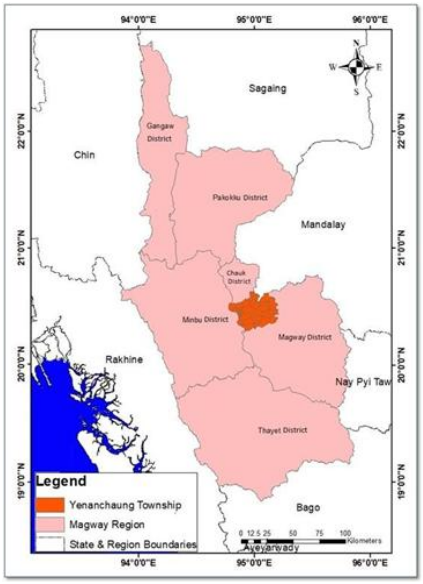

Fig. 1. Location of Yenanchaung Township in Magway Region

Source: General Administrative Department, Yenanchaung Township

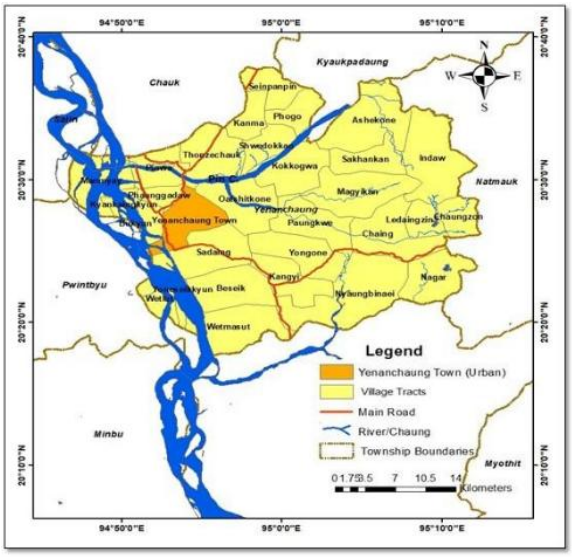

Fig. 2. Town and Village Tracts of Yenanchaung Township

Source: General Administrative Department,Yenanchaung Township

Relief and Drainage

The eastern boundary of Yenanchaung Township is marked by the spurs of Mount Popa, forming the northernmost extension of the Bago Yoma range, while the Ayeyarwady River defines the western boundary. Consequently, the terrain exhibits a gradual westward decline, descending from the upland spurs toward the riverine lowlands. The landscape is predominantly characterized by undulating plains, dissected badlands, and eroded upland areas, with only a few relatively flat alluvial plains scattered across the township. These varied relief features play a significant role in influencing drainage patterns, soil distribution, and land-use suitability throughout the region.

The most distinctive geomorphological characteristic of Yenanchaung Township is its undulating topography, where elevated uplands gradually transition towards narrow lowland plains along the Ayeyarwady River. Small alluvial plains are concentrated in the west, particularly near the confluence of Pin Chaung.Broadly, the relief of the township can be divided into two distinct physiographic regions:

(a) Western Lowland Region

This region extends along the valley floors of the Ayeyarwady River and its tributaries,Pin Chaung, Phaungkwe Chaung, Magyigan Chaung, and Nagar Chaung. Situated below 152 metres, it accounts for roughly two-fifths of the township's total area. These lowlands are predominantly alluvial in origin, supporting agriculture but also prone to seasonal flooding and sedimentation.

(b) Eastern Upland Region

The upland tract occupies the northern and eastern parts of the township, rising between 213.4 metres (700 feet) and 304.8 metres (1000 feet) above sea level. This zone represents the spurs of Mount Popa, with prominent peaks such as Indaw Taung (309.9 m), Oakshitkone Taung (308 m), and Kyaukpahtoe Taung (291.4 m) forming the township's highest elevations along the eastern frontier with Natmauk Township. These uplands, dissected by minor valleys and ridges, not only create a rugged topography but also regulate the local drainage pattern.

Drainage System

Hydrologically, Yenanchaung Township is relatively well drained by the Ayeyarwady River and its network of seasonal streams. The Ayeyarwady, flowing north–south for nearly 20 miles within the township, forms a natural western boundary and constitutes the principal waterway, vital for transportation and riparian agriculture. Sandbars and islands (locally known as kyun) emerge during the dry season, facilitating kaing-kyun cultivation, particularly in Bukyun, Kyankaingkyun, Yonezeikkyun, and Manmay tracts.

Among the tributaries, Pin Chaung is the most significant, originating in the Mount Popa highlands and traversing the township before joining the Ayeyarwady near Pinwa Village. Its banks, enriched with fertile alluvium, support rice, onion, and mixed cropping systems. Other streams are Phaungkwe Chaung, Wetpoe Chaung, Magyigan Chaung, Sabamhyaw Chaung, Nagar Chaung, and Kadaung Chaung are also arise from the eastern uplands, flowing southwestward to merge with Pin Chaung or the Ayeyarwady. Most of these channels exhibit pronounced seasonal variation, carrying strong flows during the monsoon yet becoming sand-choked or intermittent in summer. Collectively, this interplay between undulating uplands, fertile

floodplains, and a dendritic drainage network defines the geographical identity of Yenanchaung Township, conditioning both land-use patterns and the agricultural economy.

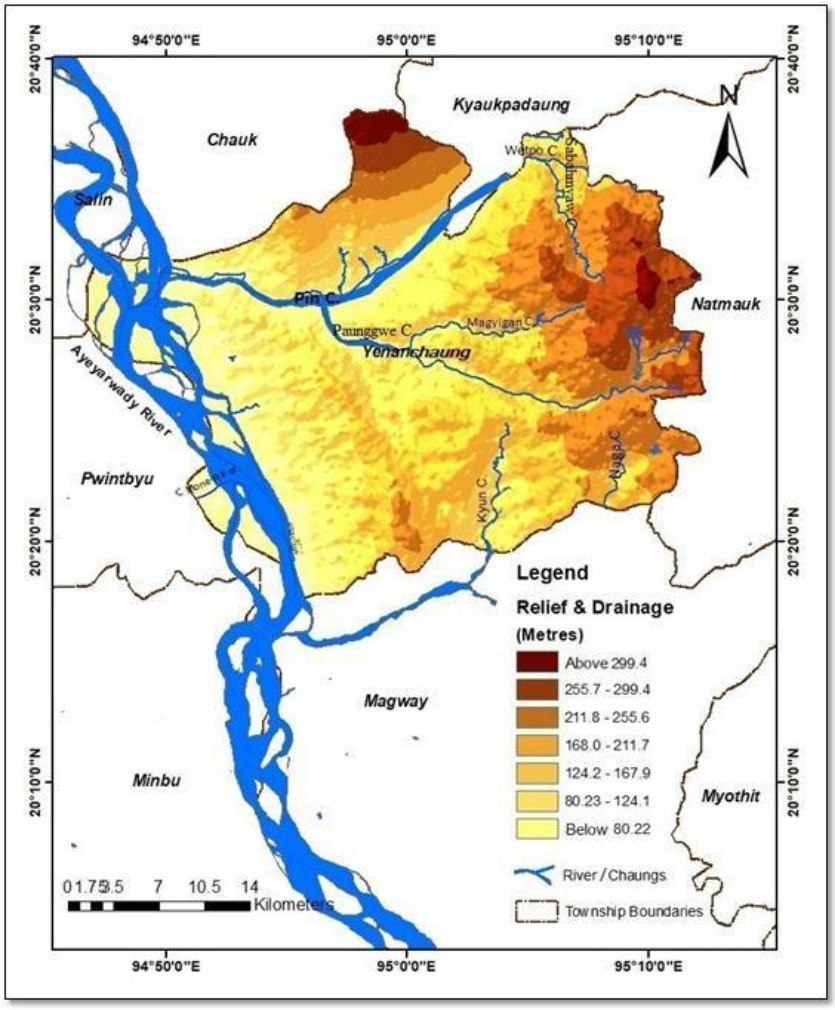

Fig. 3. Relief and Drainage of Yenanchaung Township (Source: Digital Elevation Model (30m))

Geographical Significance for Oil Seed Crops

The low-lying alluvial plains near the Ayeyarwady River provide relatively fertile soils, supporting better yields of groundnut, sesame, and sunflower. In the upland and hilly areas, oil seed cultivation is more vulnerable to rainfall variability, high temperatures, and declining soil fertility due to erosion. The drainage system influences both irrigation potential and flood risk; while river proximity benefits crop growth in some areas, excessive flooding in lowlands can damage crops. The drainage pattern is mainly dendritic, reflecting runoff from upland areas into lower plains.Steep slopes in the upland zones cause rapid surface runoff and soil erosion, while the low-lying flood plain areas accumulate alluvial deposits.

Soils of Yenanchaung Township

Soil distribution in Yenanchaung Township exhibits significant spatial variation, influenced by relief, climate, and natural vegetation. Five primary soil types are recognized: alluvial, meadow alluvial, degraded red-brown savanna, red-brown savanna, and primitive crushed stone soils (Figure 1.8). Alluvial soils, located along the Ayeyarwady River in the west, are fertile (pH 6–8) and support groundnut, pulses, sunflower, maize, and vegetables due to their water-retention and nutrient-rich properties. Meadow alluvial soils along Pin Chaung and Paunggwe Chaung (pH 5.5–6.5) are rich in humus, suitable for groundnut, maize, sesame, pulses, and vegetables. Degraded red-brown savanna soils in the western township (pH 6.5–8.0) are appropriate for dry farming, while red-brown savanna soils in the northern and eastern regions (pH 6.5–7.5) contain moderate lime with high calcium and magnesium, supporting sesame, groundnut, pulses, and maize. Primitive crushed stone soils in the eastern hilly areas (pH 6–6.5) are unsuitable for cultivation and are covered by than, dahat, and thorm forests.

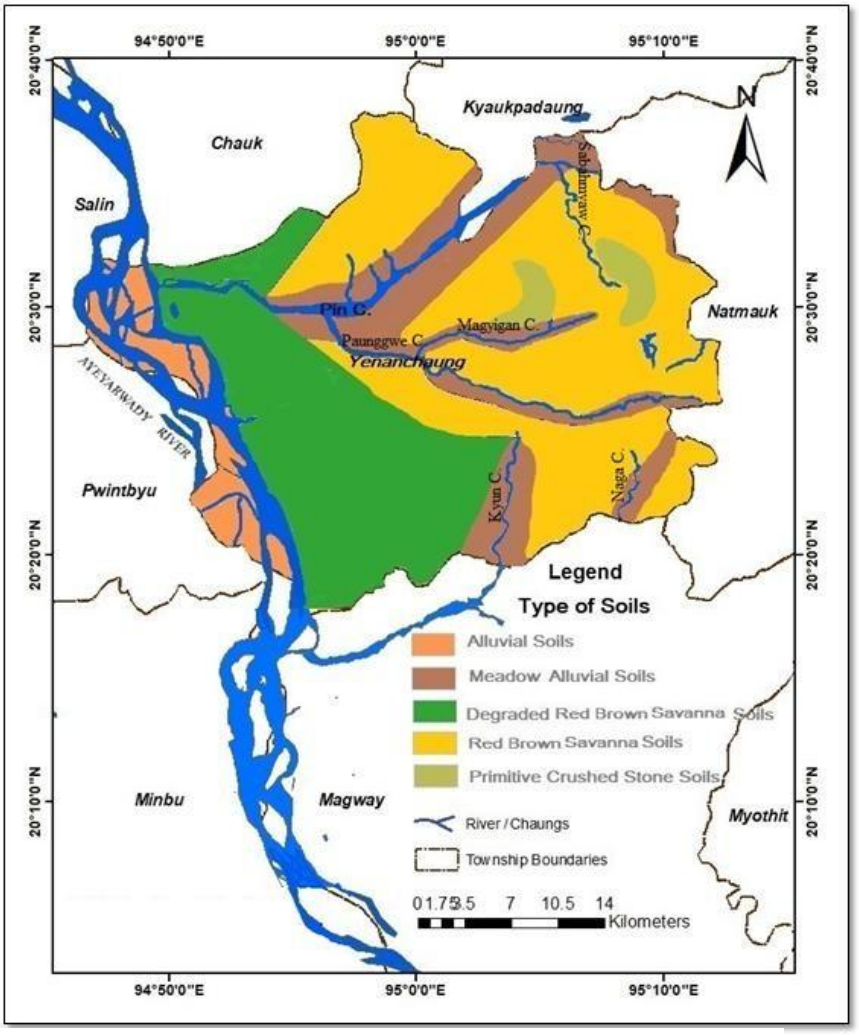

Fig. 4. Soil Map of Yenanchaung Township
(Source: Soil Department of Yenanchaung Township)

Table 1 Temperature and Rainfall of Yenanchaung Township

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg/Tot
Max Temp;(°C)	30.56	35.21	42.22	41.23	38.92	36.57	34.59	34.88	34.99	34.46	34.46	30.32	35.7
Mean Temp;(°C)	21.43	24.2	29.09	31.34	31.11	30.37	29.03	29.38	29.23	28.71	25.64	22.34	27.66
Mini Temp;(°C)	12.31	14.3	18.55	21.39	23.31	24.18	23.51	23.92	23.52	19.04	19.04	14.36	19.79
Rainfall(mm)	0	0	0	6.35	87.38	110.49	64.26	93.73	117.86	128.27	9.91	4.32	622.55

(Source: Meteorology and Hydrology Department, Yangon)

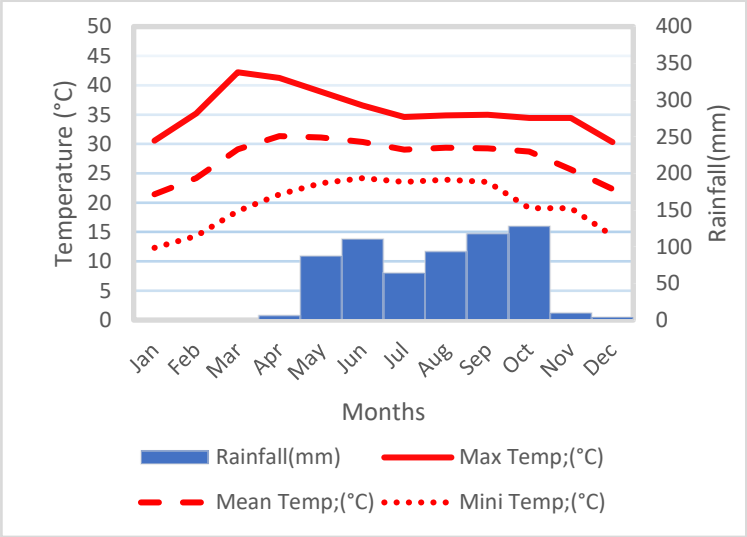

Fig. 5. Climograph of Yenanchaung Township (Source: Based on table 1)

According to the Köppen Climate Classification, Yenanchaung Township falls under the Aw type (Tropical Savanna Climate), which is marked by a pronounced wet and dry season. The climatic data show extremely high temperatures during March and April, with rainfall concentrated mainly between May and September due to the southwest monsoon, followed by a prolonged dry season extending from November to February. This climatic setting strongly influences the cultivation of oilseed crops, as the dry pre-monsoon period allows for land preparation and sowing, while the onset of monsoon rainfall provides essential soil moisture for crop establishment and growth. However, the heavy rainfall in peak monsoon months can cause waterlogging, posing risks to crop yields. In contrast, the dry and cooler winter months provide favorable conditions for harvesting and post-harvest storage by minimizing moisture-related losses. Thus, within the framework of the Köppen system, the Aw climate type plays a critical

role in shaping the seasonal agricultural practices and productivity of oilseed crops in Yenanchaung Township.

Agricultural Land of Yenanchaung Township

The agricultural land-use structure of Yenanchaung Township in 2024–2025 demonstrates distinct spatial variations across its wards and village tracts. Out of the total township area of 100,739 hectares, approximately 35,127.95 hectares (34.9%) are under agricultural use, of which 33,772.26 hectares represent net sown area, while 1,355.69 hectares are left fallow. This indicates that the majority of cultivable land is actively utilized, reflecting the township's reliance on agriculture as a key source of livelihood. Village tracts such as Indaw (2,919.8 ha), Magyigan (2,367 ha), Seinpanbin (2,195 ha), Kangyi (2,166.28 ha), and Phoekoe (1,897.16 ha) account for the highest concentrations of cultivated land, suggesting fertile soils and relatively favorable conditions for crop production. In contrast, tracts such as Bugyun, Kyankaingkyun, Manmyay, Wetlut, and Yonezeikkyun show no reported agricultural activity, possibly due to unfavorable topographic or soil conditions, or because the land is reserved for other uses.

The prevalence of oilseed crop cultivation in Yenanchaung is closely linked to this spatial pattern of land use. Oilseeds, which thrive under semi-arid conditions with distinct wet and dry seasons, align well with the township's climatic context under the Köppen Aw (tropical savanna) classification. The concentration of net sown area in village tracts with larger holdings provides opportunities for scaling up oilseed production, while fallow areas highlight the potential for agricultural expansion if supported by irrigation and sustainable land management practices. Overall, the land-use data underscore both the opportunities and the constraints for enhancing oilseed crop productivity in Yenanchaung Township.

Table 2 Agricultural Land of Yenanchaung Township (2015-2016 and 2024-2025) (Hectare)

Year	*Le* Land (Hectare)	*Ya* Land (Hectare)	*Kaing-kyun* (Hectare)	Garden Land (Hectare)	Total Net Sown Area (Hectare)
2015-2016	206.38986	35134.43383	3638.531826	4.451546	38983.80707
2016-2017	206.38986	35130.79166	3847.349802	4.451546	39188.98287
2017-2018	206.38986	35129.5776	3593.206994	4.451546	38933.626
2018-2019	206.38986	35128.36354	3596.444482	4.451546	38935.64943
2019-2020	206.38986	35128.36354	3677.786368	4.451546	39016.99132
2020-2021	206.38986	35127.95886	3625.177188	4.451546	38963.97745
2021-2022	206.38986	35127.95886	3620.725642	4.451546	38959.52591
2022-2023	206.38986	35127.95886	3624.772502	4.451546	38963.57277
2023-2024	206.38986	35127.95886	3624.772502	4.451546	38963.57277
2024-2025	206.38986	35127.95886	3571.35395	4.451546	38910.15421

Source: Land Records Department, Yenanchaung Township

Cultivation and Production of Oilseed Crops in Yenanchaung Township

Between 2015–2016 and 2024–2025, Yenanchaung Township exhibited significant changes in the cultivation and production of oil seed crops. Cultivated area increased from 56,265 ha to 167,803 ha, with matured area closely tracking sown area, indicating effective crop management. Yield per hectare fluctuated, from a high of 148.29 in 2015–2016 to a low of 77.34 in 2018–2019, before recovering to 93.63 by 2024–2025. Total production followed a similar pattern, reaching 6,176,530 by 2024–2025. Spatially, central and midland zones produced the highest oil seed outputs, while western and eastern hilly areas yielded less, emphasizing the influence of soil fertility, rainfall distribution, and local farming practices on oil seed crop productivity.

Table 3 Cultivation and Production of Oilseed Crops in Yenanchaung Township (2015-2016 and 2024-2025)

Year	Cultivated Area	Matured Area	Yield Per Hectares	Production
2015-2016	56265.29	56265.29	148.29	3623808.35
2016-2017	56023.13	56023.13	147.79	3351011.89
2017-2018	99636.76	99636.76	128.37	5176589.49
2018-2019	103550.87	103550.87	77.34	3241439.13
2019-2020	96829.67	96829.67	115.50	4525387.33
2020-2021	135486.42	135486.42	102.23	5585670.51
2021-2022	133603.50	133603.50	103.39	5589984.93
2022-2023	165746.62	165746.62	88.71	5949684.94
2023-2024	166890.71	166890.71	91.38	6171091.45
2024-2025	167802.52	167802.52	93.63	6176530.18

Source: Agriculture Department of Yenanchaung Township

Spatial analysis on Correlation Method

In correlation analysis between temperature and crop production, temperature is treated as the independent variable (X-axis) because it influences crop growth, while production is the dependent variable (Y-axis), reflecting the outcome of temperature variations. This setup allows a clear assessment of how changes in temperature affect agricultural productivity. The degree of correlation between in correlation analysis between temperature and crop production by the Speraman's Rank Correlation Coefficient Method.

The Correlation Degree $rs = 1 - \frac{6\sum d^2}{n3-n}$

$$= 1\text{-}\frac{6\times 101}{10^3\text{-}10}$$

$$= 1\text{- } 0.6181$$

$$= +0.3879$$

r_s = degree of correlation

d = difference

n = number

According to the calculated value r_s=0.4, there is a positive correlation but low degree between temperature and oilseed crop production in Yenanchaung Township. This finding implies that increments in temperature are generally associated with slight increases in the yield of oilseed crops such as groundnut, sesame, and sunflower. The positive correlation suggests that moderately high temperatures contribute to plant growth, seed development, and oil accumulation, which are particularly favorable in the semi-arid conditions of Yenanchaung. Nevertheless, the relatively low degree of positive correlation highlights that temperature alone is not a dominant factor in determining yield. Other agro-environmental conditions such as rainfall variability, soil moisture availability, irrigation practices, and land management exert significant influence on overall production levels. In essence, a correlation value of 0.4 reflects a supportive yet limited role of temperature in oilseed crop productivity, pointing to the need for an integrated understanding of climatic and environmental factors in shaping agricultural outcomes in the region.

Table. 4. Work Table for Correlation Degree

No	Temperature(X)	Production(Y)	d	d^2
1	29.12 (1)	3623808.34 (8)	7	49
2	26.77 (9)	3351011.89 (9)	0	0
3	26.49 (10)	5176589.49 (6)	4	16
4	27.70 (8)	3241439.13(10)	2	4
5	28.09 (6)	4525387.33(7)	1	1
6	28.81 (2)	5585670.51(5)	3	9
7	28.02 (7)	5589984.93(4)	3	9
8	28.62 (4)	5949684.94(3)	1	1
9	28.10 (5)	6171091.45(2)	3	9
10	28.73 (3)	6176530.18(1)	2	4
				$\sum d^2$=101

Source: Education Office Dagon Myothit (South) Township

Conclusion

The geographical assessment of oilseed crop production in Yenanchaung Township has illuminated the multi-scalar interplay between climatic conditions, environmental resources, and agricultural practices. The statistical analysis indicated that temperature exerts a moderately positive correlation with oilseed crop productivity (rs = +0.4). This suggests that in a semi-arid environment such as Yenanchaung, the rise in temperature within an optimum threshold enhances physiological processes associated with crop growth and oil accumulation in groundnut, sesame, and sunflower. Yet, this positive relationship remains only partial and insufficient to explain yield variations in a deterministic manner. From a geographical perspective, the productivity of oilseed crops emerges not from a single climatic driver, but from

the integration of diverse spatial and environmental factors. Rainfall distribution, soil fertility gradients, irrigation accessibility, and farmers' management strategies function together in shaping the agricultural landscape. In particular, the spatial unevenness of rainfall across Yenanchaung reflects the inherent variability of the Dry Zone climate, creating micro-regional contrasts in crop performance. Soil properties ranging from sandy alluvial plains along the Ayeyarwady corridor to clayey uplands further reinforce these spatial differentials, underscoring the significance of geographical conditions in determining land suitability for oilseed cultivation. The analysis also highlights the duality of Yenanchaung's semi-arid climatic regime: while elevated temperatures promote photosynthetic efficiency and oil biosynthesis, recurrent water scarcity constrains the stability of production. Such a paradox exemplifies the concept of environmental opportunity and constraint, central to geographical inquiry. Moreover, irrigation infrastructure and the locational accessibility of water sources emerge as decisive spatial factors mediating the vulnerability of cropping systems to climatic stress.

In conclusion, oilseed crop production in Yenanchaung Township must be interpreted as a complex geographical phenomenon, governed by the convergence of climate, soil, hydrology, and human agency. Temperature plays a contributory yet non-dominant role within this system. Therefore, sustainable production strategies require a holistic, place-based geographical approach, integrating climatic adaptation, soil fertility management, and water-resource optimization. Such an approach not only aligns with the ecological realities of the Dry Zone but also enhances the resilience and long-term viability of oilseed cultivation within Myanmar's agrarian landscapes.

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