

Reviewing 30-Years Climatology Trend in Malaysia – Exploring Potential of Sustainable Agricultural Activities

Nurina Alya Abdullah¹, Nur Syazwani Shamsul Batmi¹,
Nurliyana Mohd Shazali¹, Mohd Saufi Bastami²

¹Faculty of Administrative Science & Policy Studies, Universiti Teknologi MARA (UiTM),
Cawangan Negeri Sembilan Kampus Seremban

²Malaysian Agriculture Research & Development Institute (MARDI), Selangor

Corresponding Author : yanashazali@uitm.edu.my

Abstract

Climate change plays a vital role because it has a significant impact on all living creatures on earth. Analysing the trajectory of the climate is critical in determining the pattern of changes since it provides an initial perspective for future forecasts. In this study, a trend analysis was carried out to identify the pattern of changes for four weather parameters such as yearly precipitation (mm), yearly maximum temperature (°C), yearly average humidity (%) and yearly radiation (MJ/m) from 1992 to 2022. A comparative study was carried out in three different locations in Malaysia (Sintok, Gunung Brinchang and Chuping). The data of 30 years of climatology was extracted from NASA Power. As a result of this analysis, the precipitation trend is influenced by the maximum temperature in these locations and maximum temperature showed an upward trend for every 10 years. Opposingly, the humidity in Gunung Brinchang showed insignificant changes although the humidity is increasing both in Sintok and Chuping. The radiation showed no trend all in three locations.

Keywords: Climate change; Climatology; Weather parameters; Temperature; Humidity

INTRODUCTION

Received: 1 April 2026
Accepted: 1 May 2026
Published: 30 June 2026

United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as “*a change which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and an addition to natural climate variability observed over comparable time periods*”. Generally, climate change refers to the shift in weather over time, whether due to natural variability or due to human activity (United Nations, 2024). Since climate change works interchangeably with the changes of weather and global temperature, there is no doubt that it may create anxiety among people about what will happen soon. Rapid weather shifts such as flash floods, hurricanes, and earthquakes have been part of the global major news recently.

Intergovernmental Panel on Climate Change (IPCC) warned that the global temperature will rise to 1.5° Celsius (C) or even 2°C in the next decade if the greenhouse gases emissions are not being reduced. The average global temperature had increased by about 1.1°C from 1850 to 1900, and the heat increment was still being prevailed (Arias

et. al., 2021).

There are many studies discussing the effects of climate change. The rise in global temperatures because of climate change has a high impact for the earth's ecosystems and other natural systems such as extreme climate events, including heat waves. A heat wave event is a prolonged period of abnormally hot weather and anticipated to become more frequent, longer, and severe with the warming of the earth's climate. An extreme heat wave can affect serious health concerns, especially heat stress and heat stroke among the sick and the elderly (Suparta & Yatim, 2017).

In Malaysia, '*Monsoon Barat Daya*' or southwest monsoon happens annually, from May to September. It is a weather pattern in which the number of days without rain is greater than the number of rainy days in most states. This monsoon occurs during the hot and dry season in Malaysia, whereby the strong solar heating leads to an increase in temperature. Hence, it leads to hot conditions and heatwaves in which the temperature index is between 37 to 39°C for three consecutive days. With the low rainfall in certain areas of Peninsular Malaysia and in the Borneo (except for West Sabah), drought conditions may occur, and affecting the ecosystem around those areas (MET Malaysia, 2024).

Therefore, a study on the weather projection review for 30 years in selected areas is crucial to be understood in finding potential sustainable agricultural activities in response to the climate change impacts towards the ecosystem.

Objectives of the Study

- To analyse the projection of maximum temperature for 10 to 30 years as the temperature rise is forecasted between 1.5°C and 2°C every year.
- To highlight the potential crops plantations based on the climatology review in Sintok, Gunung Brinchang and Chuping, Malaysia.

RESEARCH METHOD

This study has used comparative data from NASA Power website, under agroclimatology (see Figure 1). This variable is able to provide data on climate studies and adaptation plans, especially for agriculture, in which it is easy to analyse and

interpret. The trend that has been studied are from 1992 to 2022 for Sintok, Kedah, Gunung Brinchang, Pahang and Chuping, Perlis. These places are among the potential sources for agricultural export throughout Peninsular Malaysia and might be internationally.

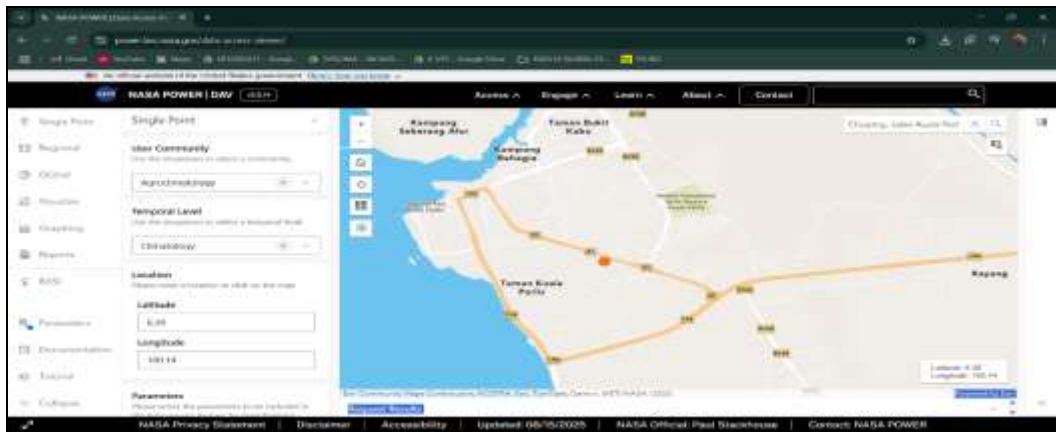


Figure 1: Nasa Power Data

Sources: <https://power.larc.nasa.gov/data-access-viewer/>

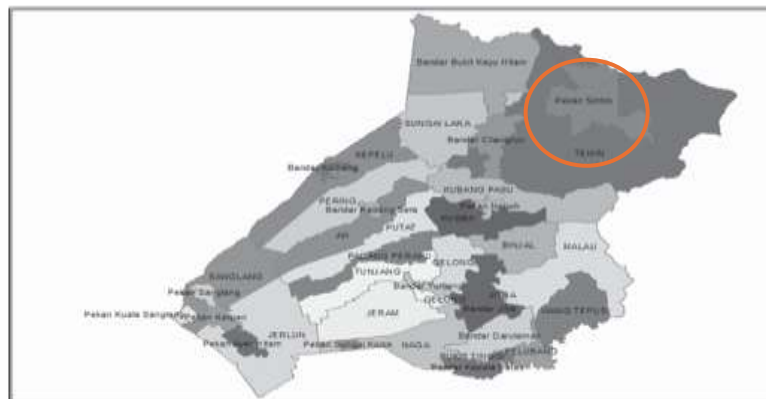
From the NASA Power website under agroclimatology, several basic parameters have been chosen i.e. humidity, maximum temperature and precipitation. Then, the raw data is extracted into excel work sheet (Figure 2). In order to analyse the data, pivot table helps to show the highest temperature and precipitation. Both precipitation and temperature have effects on each other. Thus, the reseachers need to combine both parameters in one graph to get the reading.



*Figure 2: Data Extraction and Conversion Process
Climatology Review in Sintok, Gunung Brinchang And Chuping, Malaysia : Discussion
on Potential Agricultural Activities*

A. Sintok, Kedah

Sintok is one of the sub-urban areas located in Kubang Pasu district, Kedah Darul Aman. It is well known for having the northern public university in the Peninsular i.e. Universiti Utara Malaysia (UUM). Geographically, this small town is surrounded by mountains and hills, and suitable for agriculture.



*Figure 3: Map of Sintok in Kubang Pasu, Kedah
Source: Zh9567, Wikimedia Commons, 2024*

In further analysis, Figure 4 provides information regarding the climatology of Sintok in 30 years.

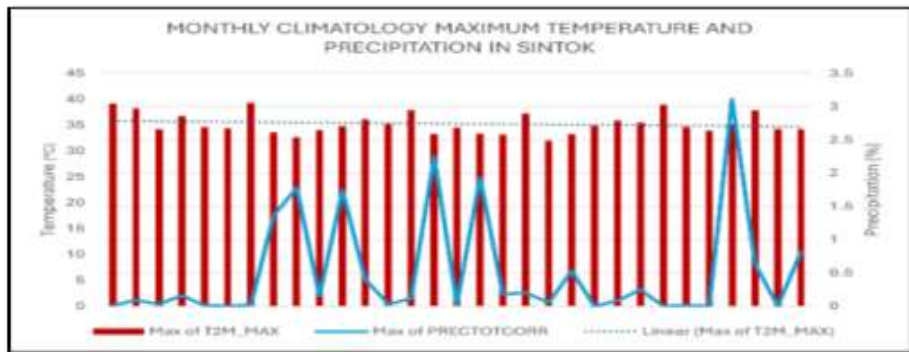


Figure 4: 30 years Climatology in Sintok, Kedah

For 30 years, Sintok experienced an even maximum temperature rate, in which the difference in its temperature readings was trivial between the years (between 0.66°C to 4.29°C, from 2016 to 2020). For 5 years, the average temperature readings were considered as hot i.e. 36.09°C in Sintok (NASA Power Data, 2025). In addition, the average yearly humidity was also relatively increased throughout the 30 years whereby the highest humidity was in year 2011 at 83.62%. The precipitation trend in Sintok is flat for 7-10 years starting from 2009 to 2018 at the rate of 2018 (0 (mm/day)) to 2009 (1.93 (mm/day)). Here, it could be said that Sintok had experienced a high level of climate change throughout 30 years, though humidity and the rainfall there helped to cool the place down.

Based on Sintok's climate, hybrid grain corn probably has the potential to be grown and commercialised, as it is suitable to live at a temperature between 27°C to 32°C. Grain corn (also known as "cow corn") is fit to be harvested with humid temperature conditions at a rate of 20-25%. This type of corn also requires 500mm-800mm of precipitation to grow bountifully (Jabatan Pertanian Malaysia, 2020). Usually, grain corn is planted as the livestock's feed and it can help to reduce the dependence on imported food for the local poultry in Malaysia, in which it is related to the increment of sustenance prices in the market (Nik Sharifulden, 2023). This plant will partially help to reduce the heavy reliance of livestock foods export to Malaysia and indirectly, reduce the nation's money outflow by generating local incomes to the local farmers.

Another promising crops are the Harumanis mangoes. Though these mangoes are more popular and mostly populated in Perlis, a vacant plot in MARDI Sintok provides a potential area for harvesting these premium mangoes to fulfill the increment of local and international demands (Muhamad Hassan, et. al, 2019). The details of Harumanis mangoes is explained in another feasible area of Chuping, Perlis.

B. Gunung Brinchang

Located on the border of Cameron Highland, Pahang and Kampar, Perak, Gunung Brinchang is the second highest peak accessible by land transportation, besides Gunung Irau. It is one of the most popular tourist attractions in the Peninsular of Malaysia, as the climate is colder than the other places (Majlis Daerah Cameron Highlands, 2025).

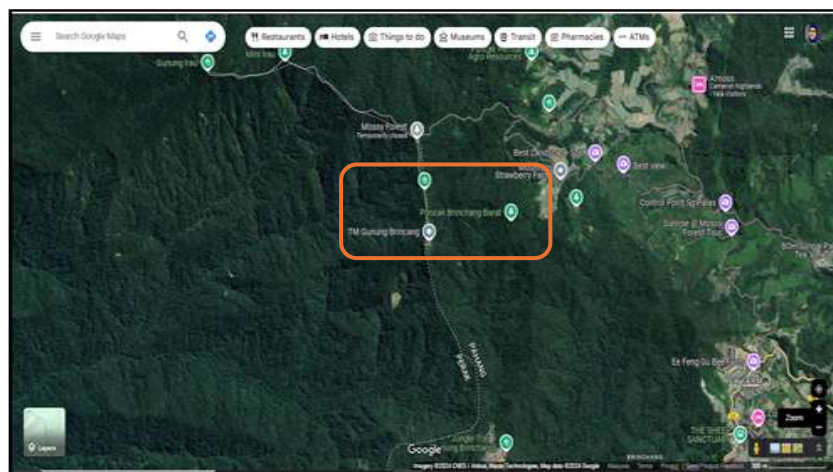


Figure 5: Map of Gunung Brinchang in Pahang/Perak Border
Source: Google Map, 2025

Figure 4 reflects the climatology of Gunung Brinchang for the past three decades.

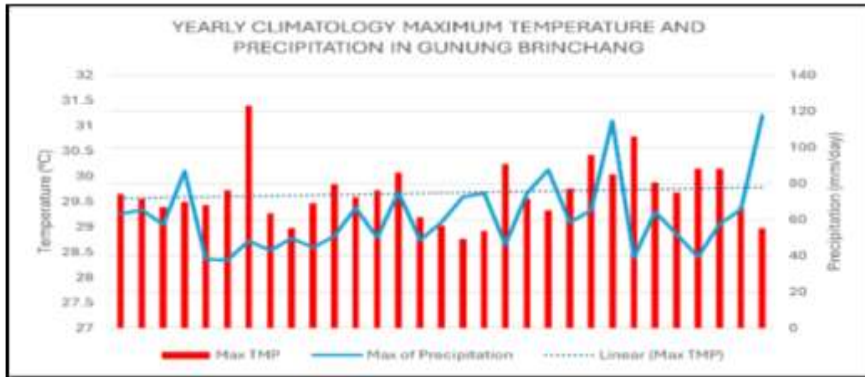


Figure 6: 30 years Climatology in Gunung Brinchang

Throughout the three decades, the climate here seemed to be in the average of 29.5°C, with the highest temperature recorded in 1998 (31.4°C) and the lowest temperature was recorded 10 years later (28.8°C). The temperature difference was not obvious, and the majority temperatures were nearby the average degree. As for its average yearly humidity, it was relatively constant, ranging between approximately 87% to 88% throughout the 30 years. Rainfalls in Gunung Brinchang were increasing from year to year, though it received less precipitation in some of the years. It was since the rainfall here was heavily influenced by the temperature. In other words, the lower the temperature of the year, the higher the precipitation rate, like for an example, in 2022, the temperature is at 29°C and the precipitation is the highest in 30 years 3402.8 (mm/day).

The climatology in Gunung Brinchang seems suitable for growing chilies. Chilies are popular in Malaysia, and it is an important ingredient in several main dishes like curry, the northern soups and of course, *sambal*. These plants are considered as the high value crops among the local farmers due to their continuous demand in the market. Moreover, chilies are easy to live in the high or low land (in moderate temperature) (Mat Rashid, 2024). With its moderate temperature, plus with the highland geographic location, Gunung Brinchang has the potential to be the main hub for chilies in Malaysia.

In another perspective, preserving the nature in Gunung Brinchang is crucial to be considered. Herbs are also having the potential to be grown in the Highland without distressing its natural ecosystem and biodiversity. Herbs such as Ceylon Cinnamon, Kacip Fatimah (scientifically known as *Labisia pumila Benth*), Centella Asiatica and

Ylang Ylang (Jabatan Perhutanan Semenanjung Malaysia, 2025) can possibly being cultivated naturally here and provides another economic opportunity for the local people, while sustaining the current environment.

C. Chuping, Perlis

Chuping is a small town in Perlis, the most northern state in the Peninsular. Chuping is well known as the hottest location in Malaysia (highest temperature of 40.1°C in 1998 and 37.7°C in March 2023) (MET Malaysia, 2024). Historically, it was the main hub for processing sugar in Malaysia. Due to limited supply of sugar and decrement of its land fertility, sugar cane plantations were closed, and it provided a huge economic impact to local people (Abdullah & Sahidan, 2021).

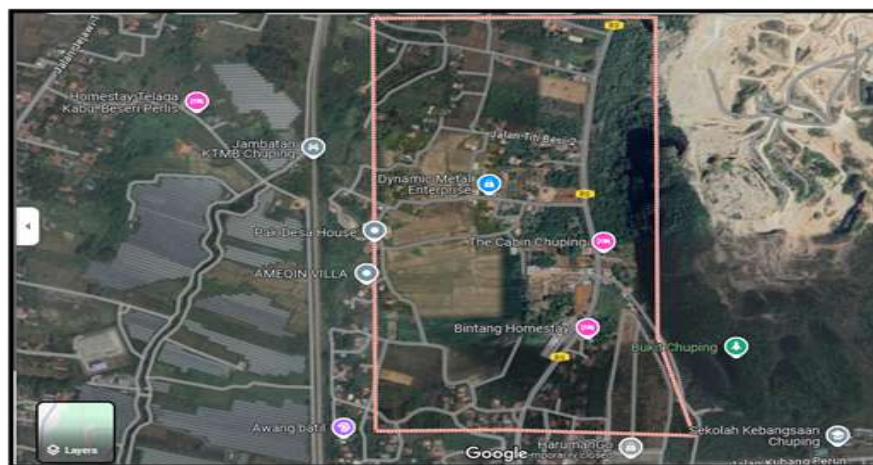


Figure 7: Map of Chuping, Perlis
Source : Google Map, 2025

The following figure shows the 30 years of climatology in Chuping.

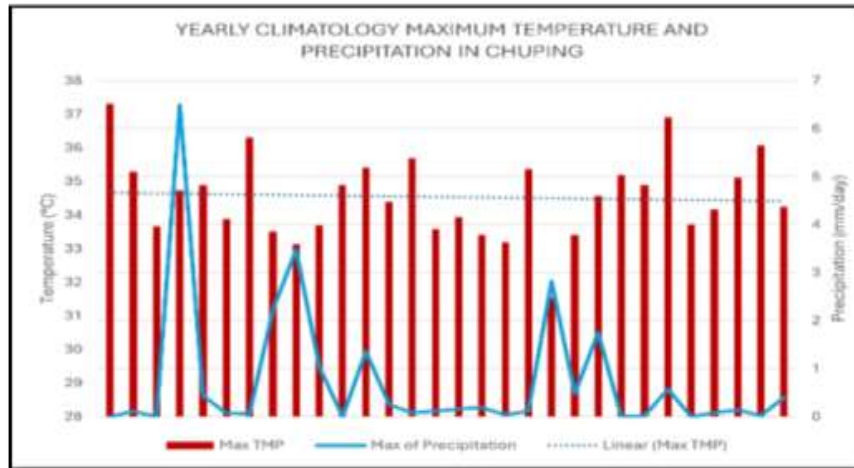


Figure 8: 30 years Climatology in Chuping, Perlis

Based on Figure 5, the maximum temperature trend in Chuping was seen to fluctuate from year to year. As an example, in 1992 the temperature was 37.3°C and declined to 35.3°C in the following year. Here, the rate of precipitation was influenced by the temperature; the lower temperature of the year, more rainfall was experienced and vice versa. It was demonstrated in 2000 (whereby the rain fell at 39.84 mm/day) and in 2016 (only 9.07 mm/day when the temperature rocketed to 36.9°C). Though heavy rainfalls experienced when the temperature was low, Chuping was still being the hottest spot in Malaysia.

As Perlis is popular for its Harumanis mangoes, its initial plantation can possibly be introduced here. Mangoes are suitable to be planted in a location, whereby that area experiences a relatively long dry condition (between 2 – 4 months), with the temperature around 24 - 30°C for the plant to produce its flowers. Chuping is experienced relatively dry season during the month of December to March every year, while the downpour season is expected afterwards (Kerajaan Negeri Perlis, 2015). The weather combination is needed for supporting the phenological stages of Harumanis mangoes. Vacant plots are possible to be rented out to the local farmers, with the help from local authorities and agencies, such as DOA and MARDI Perlis.

As one of the promising projects of securing sustenance in Malaysia, Chuping Agro Valley is launched in December 2024 by Raja Muda Perlis. Among the high valued crop suggested to be planted in Zone 2 of the Valley is MD2 pineapple (Osman,

2024). MD2 pineapple needs an average temperature between 20-30°C for optimum growth (MPIB, 2022; Hasni and Ahmad, 2022). Nonetheless, with the help from IoT smart farming technology like Blynk (a mobile application) to monitor real time condition of the field, MD2 pineapple trees are possible to grown here though the highest temperature recorded is 41°C (Hasni and Ahmad, 2022).

CONCLUSION

From the figures shown, the maximum temperature in all three places seemed to be in an upward trend. On average, the maximum temperature in Gunung Brinchang is lower than in Sintok and Chuping. As for the humidity level, Gunung Brinchang depicted slightly lower than in Sintok and Chuping. Based on the trend analysis, it can be said that April is the hottest month in 30 years in which the highest temperature in Sintok and Chuping (above 40°C and 37°C respectively).

Therefore, it can be summarized that the increment in local temperature has effected the humidity and precipitation level. It is a possible sign of climate change happened also in Malaysia and definitely affected the source of food in the country. With smart farming technology combining with green effort emphasised by the state government and local agencies, the nation's sustenance can be secured in longer terms and indirectly, it can help to boost Malaysian exported values, besides generating in-house economy of the country.

Acknowledgements

A warmth gratitude goes to Dr Mohd Saufi Bastami (MARDI, Selangor) as the resource person and supervisor for teaching and guiding the main reseacher (Nurina Alya) to gain new knowledge of understanding the impact of environment on agriculture during their internship in early 2024.

Funding

This paper has not been funded by any organisation.

Author contributions

Nurliyana Binti Mohd Shazali – a research supervisor to Nurina Alya and Nur Shazwani; as a corresponding author.

Nurina Alya Abdullah – the main researcher; an intern in MARDI Selangor.

Nur Syazwani Shamsul Batmi – 2nd researcher; finding information and compiling the study.

Dr Mohd Saufi Bastami (MARDI, Selangor) – as the resource person and supervisor for Nurina Alya.

Conflict of interest

No conflict of interest associated to this publication

References

- Abdullah, N. A., & Sahidan, A. S. (2021). Dokumentari Misteri Kehilangan Tebu Chuping, Perlis. *International Journal Law, Government and Communication*. 6(26), pp. 138-147. DOI: 10.35631/IJLGC.626012.
- Arias, P.A., N. Bellouin, E. Coppola, R.G. Jones, G. Krinner, J. Marotzke, V. Naik, M.D. Palmer, G.-K. Plattner, J. Rogelj, M. Rojas, J. Sillmann, T. Storelvmo, P.W. Thorne, B. Trewin, K. Achuta Rao, B. Adhikary, R.P. Allan, K. Armour, G. Bala, R. Barimalala, S. Berger, J.G. Canadell, C. Cassou, A. Cherchi, W. Collins, W.D. Collins, S.L. Connors, S. Corti, F. Cruz, F.J. Dentener, C. Dereczynski, A. Di Luca, A. Diongue Niang, F.J. Doblas-Reyes, A. Dosio, H. Douville, F. Engelbrecht, V. Eyring, E. Fischer, P. Forster, B. Fox-Kemper, J.S. Fuglestad, J.C. Fyfe, N.P. Gillett, L. Goldfarb, I. Gorodetskaya, J.M. Gutierrez, R. Hamdi, E. Hawkins, H.T. Hewitt, P. Hope, A.S. Islam, C. Jones, D.S. Kaufman, R.E. Kopp, Y. Kosaka, J. Kossin, S. Krakovska, J.-Y. Lee, J. Li, T. Mauritsen, T.K. Maycock, M. Meinshausen, S.-K. Min, P.M.S. Monteiro, T. Ngo-Duc, F. Otto, I. Pinto, A. Pirani, K. Raghavan, R. Ranasinghe, A.C. Ruane, L. Ruiz, J.-B. Sallée, B.H. Samset, S. Sathyendranath, S.I. Seneviratne, A.A.

- Sörensson, S. Szopa, I. Takayabu, A.-M. Tréguier, B. van den Hurk, R. Vautard, K. von Schuckmann, S. Zaehle, X. Zhang, and K. Zickfeld. (2021). Technical Summary. In *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 33–144, doi:10.1017/9781009157896.002.
- Jabatan Perhutanan Semenanjung Malaysia. (2025). *Tumbuhan Ubatan*. Laman Web Rasmi Jabatan Perhutanan Semenanjung Malaysia. Retrieved on 24/7/2025 from <https://www.forestry.gov.my/my/tumbuhan-ubatan>
- Jabatan Pertanian Malaysia. (2020). *Keperluan Asas Tanaman : Pakej Teknologi Jagung Bijian (Edisi Pertama)*. Putrajaya, Malaysia : Jabatan Pertanian Malaysia.
- Kerajaan Negeri Perlis. (2015). *Pelan Pembangunan Lembah Chuping*. Laman Web Rasmi Kerajaan Negeri Perlis. Retrieved on 15/8/2025 from <https://www.perlis.gov.my/images/pekeliling/PELAN%20PEMBANGUNAN%20LEMBAH%20CHUPING.pdf>
- M. H. B. Hasni and S. Ahmad. (2022) Cost Effective MD2 Pineapple Smart Farming IoT Monitoring System in Chuping, Perlis. *2022 International Conference on Green Energy, Computing and Sustainable Technology (GECOST)*, Miri Sarawak, Malaysia. Pp. 215-220, doi: 10.1109/GECOST55694.2022.10010624.
- Majlis Daerah Cameron Highlands. (2025). *Gunung Brinchang*. Portal Rasmi Majlis Daerah Cameron Highlands. Retrieved on 7/1/2025 from <https://www.mdcameron.gov.my/ms/pelawat/destinasi-menarik/gunung-brinchang>

- MET Malaysia. (2024). *Fenomena Cuaca*. Jabatan Meteorologi Malaysia. Retrieved on 21/12/2024 from <https://www.met.gov.my/pendidikan/fenomena-cuaca/>
- Muhamad Hafiz Bin Muhamad Hassan et. al. (2019). Effect of Multilocation Production on the Reproductive Growth, Yield and Quality of Harumanis Mango. *International Journal of Current Advanced Research*, 08(04), pp.18175-18180. DOI: <http://dx.doi.org/10.24327/ijcar.2019.18180.3468>
- Nik Sharifulden, N. A. S. (2023). *Exploring into the Viability of Malaysia's Corn Industry*. Retrieved on 11/11/2024 from Khazanah Research Institute (https://www.krinstitute.org/assets/contentMS/img/template/editor/Anis_Views_Final_v2.pdf).
- Osman, Sholina. (2024). Chuping Agro Valley dibangunkan tempoh lima tahun – Raja Muda Perlis. *Jendela MADANI: Suara Merentasi Dunia*. Retrieved from <https://jendelamadani.net/2024/12/29/chuping-agro-valley-dibangunkan-tempoh-lima-tahun-raja-muda-perlis/>
- Suparta, W. and Yatim, A. N. M. (2017). An Analysis of Heat Wave Trends using Heat Index in East Malaysia. *Journal of Physics: Conference Series*. 852(012005), pp. 1-7.
- United Nations (UN). (2025). *What is Climate Change?* United Nations Climate Action. Retrieved on 1/8/2025 from <https://www.un.org/en/climatechange/what-is-climate-change>