



Malaysian Government Initiatives to Reduce the Impact of Climate Change Towards the Agriculture Industry

Aimi Athirah Ahmad, Shaidatul Azdawiyah Abdul Talib and Nik Rozana Nik Mohd Masdek
Economic and Social Science Research Centre and Agrobiodiversity and Environment
Research Centre, Malaysian Agricultural Research and Development Institute

INTRODUCTION

World climate is always changing. There are many evidences showing that the climate has changed in the past and will continue to change. The causes of this phenomenon are believed to be due to both natural variations and human intervention. Specifically, there are three external causes of climate change which are changes in incoming solar radiation, changes in the composition of the atmosphere and changes in the earth's surface. Natural phenomena can cause climate to change by all three mechanisms, whereas human activity (anthropogenic climate change) will change the climate by both second and third mechanisms. This anthropogenic activity will increase levels of carbon dioxide or greenhouse gas (GHG) that may have contributed to change in the global climate. Carbon dioxide and other GHG's such as methane, nitrous oxide, and hydro fluorocarbons could absorb heat radiated from the earth's surface and lower the atmosphere and reflect some of this heat back to earth, thus creating a greenhouse effect or global warming. This paper discusses issues and challenges related to climate change in Malaysia. It focuses on the Malaysian government's initiatives to reduce the short and long-term effects of climate change toward its agriculture industry.

Climate change

Climate change can be described as a change in global or regional climate pattern. Climate change means rise in average temperatures, atmospheric CO₂ concentration and soil salinity in some areas, besides lower and more irregular rainfall. Climate variability and extreme weather events are also expected to be more frequent. This phenomenon creates serious environmental issues that the world population is facing today. It became the public issues and agenda since late 1980. Since then, several research teams around the world have carried out various efforts to model the future climatic change during the 21st century, based on several scenarios of greenhouse gas (GHG) emissions. The expected impacts of global warming are enormous and would certainly be very harmful and dangerous. For example, most places will continue to get warmer, sea levels will continue to rise, and changing in weather patterns and biological systems will be affected (Donald Ahrens, 2013).

Climate change is the output of anthropogenic activity that increases the emission of CO₂ and GHG. In the agriculture sector, GHG are released from the use of fertilizers on soils, flooded rice farming, manure from livestock and enteric fermentation process in ruminants. The GHG emitted through the processes above are traced to emissions of nitrous oxide (N₂O) and methane (CH₄). The global warming potential of N₂O is 310 times greater than a molecule of carbon dioxide (CO₂) while CH₄ is 24 times greater as compared to carbon dioxide.

Based on the Biennial Update Report produced by the United Nation Framework Convention on Climate Change or UNFCCC, the agriculture sector in Malaysia contributes to an increase of 35% GHG emissions from 2000 to 2011 (BUR, 2017) (Figure 1). Due to this, Malaysia has undertaken several efforts to evaluate its mitigation actions towards achieving Malaysia's conditional voluntary indicator to reduce its GHG emissions intensity of GDP up to 40% by 2020.

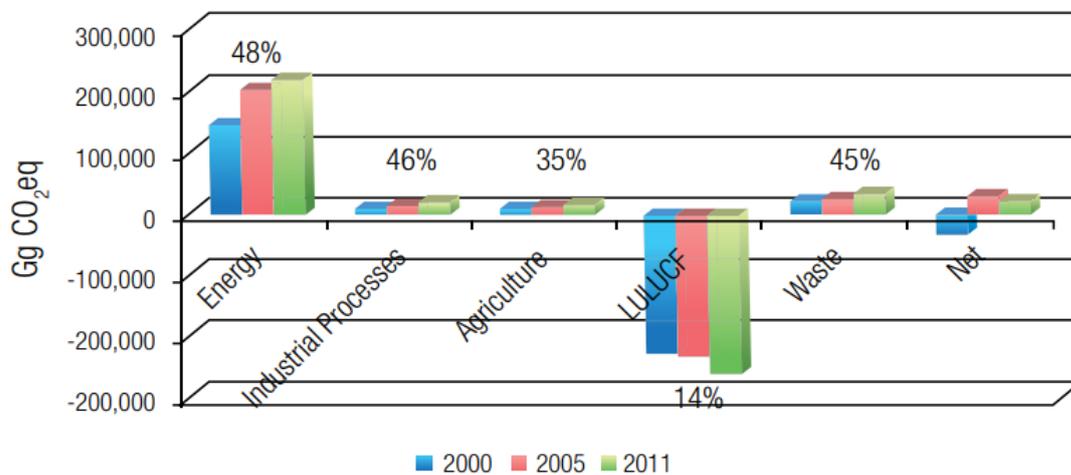


Fig. 1. Comparison of GHG Emissions by sector in Malaysia from 2000 to 2011

Source: Malaysia, Biennial Update Report to the UNFCCC (2017)

Impact of climate change to agriculture industry

Climate change is a continuous phenomenon in Malaysia. Malaysia has experienced climate change phenomena as in the following incidents:

1. Increased of annual surface temperatures from 0.6°C to 1.4°C between 1970 and 2000.
2. Increase in annual rainfall intensity from 1891mm to 2699mm between 1970 and 2000.
3. In 2007, storms caused losses of more than RM1.5 billion which were "above average" while an extreme flood event in 2014 caused losses of more than RM1 billion.
4. Satellite imagery revealed the rise in sea level between 4.6cm to 11.9cm.

(Source: Ministry of Natural Resources and Environment, Malaysia, 2018)

Climate change affected agriculture in many ways. Temperature is inversely proportional to yield at the upper range of the optimum growth curve. For example, higher temperatures will lead to a corresponding decrease in yield. Climate change is likely to have a negative impact on crop production and thus, increase the risk of food insecurity. Livestock production

may also reduce as animals are also suffering from climate change. On the other hand, rainfall variability is the major limiting factor to the productivity of many crops including oil palm, a major economic crop for Malaysia (Second National Communication, 2011).

The Muda Agricultural Development Authority (MADA) area is one of the seven rice bowls in Malaysia. It covers more than 100,000 hectares of land within the northern region of Malaysia. According to a study by a group of researchers from the Malaysian Agricultural Research and Development Institute (MARDI), MADA area is projected to face a higher temperature in the future. The Providing Regional Climates for Impacts Studies (PRECIS), projected that the daily mean temperature in the MADA area will rise up to 34⁰C with irregular pattern of rainfall. Simulation studies using Decision Support System for Agro-technology Transfer (DSSAT), a crop model projected that rice production will be negatively affected. Thus, many efforts are focusing on how to overcome this issue. For example, a study by Shaidatul Azdawiyah *et al.*, (2015, 2016) suggested that changing the planting date of rice could be a very good solution to improve rice yield under the impacts of climate change. Planting schedule were then adjusted to offset the negative impacts of climate change on rice yield. Shifting planting date for the main-season projected will improve yield production, whereas it is the opposite for the off-season. Hence, shifting planting date for main-season is recommended as a non-cost climate change adaptation strategy for rice cultivation in MADA area.

Besides rice, certain fruits are also affected by the changing climate. Mango and papaya are the most widely cultivated and popular fruits in Malaysia due to its economic and nutritional values. There is a positive correlation between climatology and yield production for both mango and papaya. High maximum temperature, ununiformed rainfall distribution pattern together with solar radiation intensity, affects yield production. The effect of weather on crop growth varies with the growth period of the crop. The influence of climatology towards crop yield depends on the magnitude and distribution of the weather variables over crop growth period. The baseline of yield projection for mango and papaya up to the year 2050 based on future climate projection may help the industry players to prepare adaptation measures to maintain yield production to meet market demand.

Increase in demand for agricultural produce and the opening of new plantation areas has led to the problem of soil erosion and landslides where rainfall has been identified as one of its natural causes in highland areas. Soil erosion caused by water affects productivity and soil quality, as it reduces the infiltration rate, water holding capacity, nutrients, organic matter, soil biota and soil depth besides disturbing the ecosystems.

Cameron Highlands is the most important agricultural region for vegetable and flower production in Malaysia. Cameron Highlands received high amount of rainfall, which is extremely helpful in generating sources of water for agricultural activities. Unfortunately, it has become one of the factors for soil erosion. Uneven distribution of rainfall due to climate change resulted in more severe landslide impact. Thus, as an adaptation measure, cultivation activities need to be done under the rain shelter with sprinkler for irrigation system as it may reduce soil loss and surface runoff percentage.

Rice cultivated under different water regimes (continuous flooded and rain-fed) shows different CH₄ fluxes where continuous flooded release higher CH₄ due to anaerobic conditions which led to methanogenesis process. Moreover, field burning of rice residues (straw and husks) which is the common practice in rice producing area in Malaysia also contribute to GHG emissions. Combination of risk husk biochar together with organic amendment (chicken dung) can be used as mitigation tool as it may reduce CH₄ emissions from continuous flooded cultivation area besides improving rice yield and growth performance.

Strategies to reduce the effects of climate change

Considering this phenomenon is a global issue, the Malaysian government is very committed to address climate change related issues and has been actively involved in international conventions. Table 1 shows a summary of the activities that Malaysia has been actively participated.

Table 1. Activities related to climate change issues that Malaysia has been actively participated

Date	Commitments
1989	Ratification of Montreal Protocol
1992	Participation at Earth Summit
1994	Ratification of United Nations Framework Convention on Climate Change (UNFCCC)
1994	Establishment of National Committee on Climate Change
2000	Submission of Initial National Communication
2002	Ratification of Kyoto Protocol and Participation at Earth Summit
2008	Establishment of Cabinet Committee on Climate Change
2009	Participation in UNFCCC COP15
2009	Establishment of National Policy on Climate Change
2009	Establishment of Green Technology and Climate Change Council
2011	Submission of Second National Communication
2012	Participation in the United Nations Conference on Sustainable Development
2016	Submission of Third National Communication and Biennial Update Report (BUR)
2016	Ratification of Paris Agreement
2017	Ratification of Doha Amendment to the Kyoto Protocol

Source: Ministry of Natural Resource and Environment, Malaysia

The Malaysian government also developed several policies that address issues related to climate change. The policies were developed as to ensure climate-resilient development is to fulfil National aspirations of sustainability. These policies provide guidelines and directions on how government agencies, NGOs and public in general react to issues and challenges related to climate change. The policies are discussed as follows:

National Policy on the Environment

The national policy on the environment was first implemented in 2002 with the aims to lay out principles and strategies for Malaysia to exploit its natural resources in a sustainable way while developing its economy. This policy aims to achieve a clean environment, safe, healthy and productive environment for present and future generation. It also aims to conserve the country's unique and diverse cultural and natural heritage through active participation of all society.

There are eight (8) principles listed under this policy which is to harmonies economic development goals with environmental imperatives:

1. Stewardship of the Environment
2. Conservation of Nature's Vitality and Diversity
3. Continuous Improvement in the Quality of the Environment
4. Sustainable Use of Natural Resources
5. Integrated Decision-Making
6. Role of the Private Sector
7. Commitment and Accountability

8. Active Participation in the International Community

This policy seeks to integrate environmental considerations into development activities and in all related decision-making processes, to foster long-term economic growth and human development, and to protect and enhance the environment. It complements and enhances the environmental dimensions of other national policies, such as those on forestry and industry, and takes cognizance of international conventions on global concerns. Some of the principles employed within this area have direct relevance towards climate change efforts such as the establishment of conservation areas, land use planning and assessments, sustainable management of forests and water resources, energy conservation and development.

National Green Technology Policy

This policy was established in 2009 which involved several sectors that have direct impact on the environment; energy, building, transport and water and waste management.

It is based on 4 pillars:

1. Energy: Seek to attain energy independence and promote efficient utilization.
2. Environment: Conserve and minimize impact on the environment.
3. Economy: Enhance national economic development through the use of green technology.
4. Social: Improve the quality of life.

National Policy on Climate Change

Malaysia realized that climate change does not only involve environmental issues alone, but also affects economic growth and human well-being. Referring to the previous national policies and initiatives that indirectly addresses climate change issues under the context of sustainable development, there is indeed an urge to formulate climate change specific policies. Many agencies have been involved in conducting the policy study with an aim to develop specific national policies or strategies on climate change in fostering sustainable development in Malaysia to meet the needs of the country and respond to the United Nations Framework Convention on Climate Change (UNFCCC).

Therefore, the National Policy on Climate Change was established in 2009 with the objectives to:

1. Mainstreaming climate change through wise management of resources and enhanced environmental conservation resulting in strengthened economic competitiveness and improved quality of life.
2. Integration of responses into national policies, plans and programs to strengthen the resilience of development from arising and potential impacts of climate change.
3. Strengthening of institutional and implementation capacity to better harness opportunities to reduce negative impacts of climate change.

In this policy, the main action is to come out with relevant adaptation and mitigation strategy to especially address issues in the agriculture sector as agriculture and climate change are interrelated.

National Renewable Energy Policy and Action Plan

Introduced in 2010 with the expectation to effectively reduce the greenhouse gas (GHG) emission and environmental pollution. In order to achieve that, the main objective is to

facilitate the growth and development of renewable energy while maintaining the environment. It also aims to enhance the utilization of indigenous energy resources to contribute towards national electricity supply security and sustainable socio-economic development.

Renewable Energy Act 2011

This act was established in 2011 with an aim to stimulate the renewable energy industry by providing appropriate economic incentives. The incentive in place is the Feed-in Tariff (FiT) system. It is a system to catalyze the generation of renewable energy and to ensure that renewable energy becomes a viable long-term investment for companies and individuals. The FiT system is expected to reduce carbon emissions and pollution, encourage energy efficiency measures and reduce dependency on fossil fuels. Thus, this act is also one of the mitigation measures towards climate change.

Besides developing those policies, Malaysia also recognized the importance of biological diversity and biodiversity. Thus, Malaysia will continue to safeguard its natural resource capital by improving and strengthening existing provisions of policy, legal and institutional frameworks. Conservation and use of biodiversity has always been addressed within the context of sustainable development in Malaysia. Malaysia also developing institutional framework to strengthen capacities for safeguarding ecosystem services and managing global biodiversity conservation, GHG emissions and land and water resources, and for promoting cross-sectoral and integrated ecosystems and land-use planning.

CONCLUSION

Climate change is inevitable yet a major challenge that has serious consequences especially in the agricultural industry across all sectors. It has already been proven to affect crop production as well as livestock production. Consequently, food security will also be threatened. Malaysia has shown its commitment and has taken proactive measures in addressing climate change related issues, either at the national level, as well as regional and global level through climate change adaptation, mitigation practices, and policy frameworks which are critical to protect the agricultural industry.

REFERENCES

- Azizi, A.A., Mardhati, M., Mohd Fairuz, M.S., Shaidatul Azdawiyah, A.T., Nurul Ain, A.B., Fauzi, J., Mohamad Hariz, A.R., Reisinger, A. 2017. Local Emission Factors Estimates for Methane Emission from Cattle Enteric Fermentation using IPCC Tier-2 Methodology. *Mal. J. Anim. Sci.* 20 (2); 1-10.
- Azizi, A.A., Mardhati, M., Mohamad Hariz, A.R., Mohd Fairuz, M.S., Shaidatul Azdawiyah, A.T., Fauzi, J., Nurul Ain, A.B., Andy Reisinger. 2016. Local Emission Factors for Methane Emission from Beef Cattle Enteric Fermentation. 37th MSAP Annual Conference, 1-3 Jun 2016, Melaka; pp. 102-103.
- Donal Ahrens, C. 2013. *Meteorology Today: An Introduction to Weather, Climate and the Environment*. Brooks/Cole, Cengage Learning. 10th Edition. ISBN -13 : 978-0-8400-5815-7.
- Malaysia, Second National Communication to the UNFCCC. 2011. Ministry of Natural Resources and Environment Malaysia. ISBN 978-983-44294-9-2.

- Shaidatul Azdawiyah, A.T., Mohammad Hariz, A.R., Mohd Fairuz, M.S., Mohamad Zabawi, A.G. 2015. Simulating the effects of changing planting date towards rice production in MADA area, Malaysia. *J. Trop. Agric. and Fd. Sc.* 43(1); 73-82.
- Shaidatul Azdawiyah, A.T., Mohamad Zabawi, A.G., Mohammad Hariz, A.R., Mohd Fairuz, M.S., Fauzi, J., Mohd Syazwan Faisal, M. 2016. Simulating Climate Change Impact on Rice Yield in Malaysia Using DSSAT 4.5: Shifting Planting Date as an Adaptation Strategy. NIAES Series No. 6: The Challenges of Agro-Environmental Research in Monsoon Asia (National Institute for Agro Environmental Sciences (Tsukuba), ISBN 978-4-931508-15-6; pp. 115-125.

Date submitted: Oct. 11, 2018

Reviewed, edited and uploaded: Oct. 22, 2018