

Impacts of Natural Disasters on the Paddy Production and its Implications to the Economy

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INTRODUCTION

Paddy production is among the important industries in Malaysia. It contributes around 71.4% of local rice requirements in 2014. Most of paddy farmers depend on paddy production as their main source of income. There are 12 granaries in Malaysia, and Kemubu Agriculture Development Authority (KADA) and Muda Agriculture Development Authority (MADA) are the major granaries, which contributed around 61% of the total paddy production in Malaysia. The KADA covers 18,439 hectares planted area while MADA covers 95,885 hectares, in 2012. These granaries have a complete infrastructure and good management system. Paddy productivity in KADA and MADA in 2012 were 4.1 tons / ha and 4.85 tons / ha respectively. However, paddy production in Malaysia, especially in KADA and MADA are facing challenges of less consistent paddy production due to incidences of floods and droughts. Moreover, floods and droughts nowadays are unpredictable and could happen anytime along the planting season which affect the socio-economic condition of farmers and the national food security.

Floods and droughts have caused losses amounting of millions of ringgit, the destruction of natural resources and environment. Paddy production areas that are at risk of floods and droughts have grown each year, especially in low-lying areas and areas with improper irrigation system, in addition to the lack of early warning systems, making farmers more vulnerable to disasters. Mon and Chang (2008) found that, the incidence of droughts had plagued six times over the period 1977-1992. Natural disasters, especially floods and droughts had led to decline in paddy production from 0.21 million metric tons in 2009 to 0.20 million metric tons in 2010, due to reduction in planted area of about 5,306 hectares (Baharuddin , 2007). According to Hasegawa (2009), natural disasters were one of the major contributors to the decline in the productivity of agricultural commodities. This is in line with Rosenzweig *et al*, (1994) which stated that, in general, about 12% - 22% of paddy productivity declined due to the effect of climate change in Malaysia. According to Alam *et al*, (2011) and Ibrahim *et al*, (2012), floods and droughts not only decreased the yield, but also resulted in the destruction of crops and indirectly affect the country's food security.

Impact of floods and droughts on paddy production

Droughts have become a serious threat to paddy production. The planted area affected by the droughts each season for the years 2003-2012 is around 6.51% to 16.73%. Table 1 shows the percentages of the area affected by droughts in the KADA and MADA. The area affected by droughts in KADA was higher than in MADA for both seasons. For the main season, 16.16% of the planted area in KADA was affected by droughts compared to MADA of 6.51%. Meanwhile for the off-season, 16.73% of the planted area in KADA was affected compared to 2.52% in MADA.

Table 1: Area affected by droughts (2003-2012)

	Area affected by droughts (2003-2012)
MADA Main Season	6.51%
MADA Off-season	2.52%
KADA Main Season	16.16%
KADA Off-season	16.73 %

Source: Paddy Production Survey Report MALAYSIA (2003-2012)

Floods frequently occur at the end of the year. Floods also can cause a serious damage to paddy planting as droughts, but the impact of flood incidents can be minimized if the farmers can adjust their planting schedule based on the predicted floods. Table 2 shows the percentages of the area affected by floods each season for the years 2003-2012 in the Kada and MADA. The area affected by the floods was higher in KADA than in MADA for off-season,

but higher in MADA compared to in KADA for main season. For the main season, 3.64% of the planted area in KADA was affected by droughts compared to MADA of 6.53%. Meanwhile for the off-season, 5.53% of the planted area in KADA was affected compared to 0.7% in MADA.

Table 2: Area affected by floods (2003-2012)

	Area affected by floods (2003-2012)
MADA Main Season	6.53 %
MADA Off-season	0.7 %
KADA Main Season	3.64 %
KADA Off-season	5.53 %

Source: Paddy Production Survey Report MALAYSIA (2003-2012)

Floods and droughts have caused serious losses to the farmers and the government and has become a risk to the national food security. Since 2003 to 2012, the estimated losses caused by droughts and floods were around RM1.3- RM18 millions each season. Tables 3 and 4 show the details of the estimated loss of paddy production for the main season and off-season at KADA and MADA for the year 2003-2012. The estimated loss due to droughts for MADA in the main season was between RM10.6 - RM16.3 million. As for the off-season, the estimated loss was around RM4-RM6 million, whereas, the estimated loss for KADA main season and off-season caused by droughts were around RM5.5 - RM8.1 million and RM5.5 - RM8.2 million, respectively. The estimated losses caused by the floods in MADA main season was around RM12 - RM18 million. The estimated loss in the MADA off-season was between RM1.3 - RM1.9 million. Next, the main season for KADA, total estimated losses due to the floods was around RM1.3 - RM1.9 million and for the off-season was between RM2.02 to RM3.07 million. Floods normally occurred at the end of the year and sometimes lasted until the beginning of the year or during the main planting season. Floods incidents are usually somewhat predictable and the impact can be reduced by using a few approaches such as using short maturation variety and changing paddy planting schedule.

Table 3: Average estimated losses of paddy caused by droughts and floods in the MADA during main season (2003-2012)

Planting stages	Main season		Off season	
	Droughts (RM million)	Floods (RM million)	Droughts (RM million)	Floods (RM million)
Planting stage 1	10.6	12	4.0	1.3
Planting stage 2	15.37	16.9	5.7	1.8
Planting stage 3	16.3	18	6.0	1.9

Table 4: Average estimated losses of paddy caused by droughts and floods in the KADA during main season (2003-2012)

Planting stages	Main season		Off season	
	Droughts (RM million)	Floods (RM million)	Droughts (RM million)	Floods (RM million)
Planting stage 1	5.5	1.3	5.5	2.02
Planting stage 2	7.6	1.8	7.7	2.83
Planting stage 3	8.1	1.9	8.2	3.07

Factors that affect the paddy production

A study was carried out to identify the effect of drought and flood incidents to paddy production in MADA and KADA in 2014. The regression model was fitted to explain the relationship between the independent variables and the paddy production in the MADA and KADA granaries area. Planted areas, droughts, floods and development were four variables used to describe the factors that affect paddy production. The results show that any 1% increase in planted areas could increase paddy production by 1.112%. Whereas, for each 1% increase of droughts would result in decrease of paddy production by 0.0308% and any 1% increase in floods would result in 0.0244% decrease in paddy production. Variables development refers to the investment to the management and development of MADA and KADA to increase the paddy yield. The results explain that for every 1% increase in the development could increase paddy production by 0.077%. The explanation is shown in the model below.

The results of the loglinear regression model are as follows:

$$\ln PP = 6.1678 + 1.112 \ln KB - 0.0308 \ln \text{Droughts} - 0.0244 \ln \text{floods} + 0.0770 \ln \text{Dev}$$

$$\text{Sig.} \quad (0000) ** \quad (0.077) * \quad (0.049) ** \quad (0041) **$$

PP = Paddy Production, KB = Area Planted, Dev = Development

** Significant at 5%

* Significant at 10%

Based on the results of a survey on farmers and farm managers, floods and droughts were the main threats that affect paddy production. They explained that unpredictable occurrences of floods and droughts, improper drainage and irrigation systems and less tolerant paddy variety to droughts and floods were the main factors that might worsen the impacts of droughts and floods to paddy production. Anyhow, some of the methods have worked well for the farmers to minimize the impacts of floods and drought. A total of 43.7% of farmers choose to adjust their planting schedule to reduce and mitigate the effects of floods and 31.3% of farmers choose to repair their drainage system which is able to drain excess water out of the rice fields. Meanwhile, producing short maturity and drought tolerant paddy varieties and construction of dams were the recommended methods to reduce the effects of floods and droughts on a long-term basis.

Recommendations

Cooperation must be strengthened between MADA, KADA and other related paddy production agencies. All plans of paddy cultivation that include crop management, planting schedule and drainage and irrigation must be properly communicated and discussed with the experts such as those from the Meteorological department and other research institutions to ensure that the effects of floods and droughts can be minimized.

The infrastructure and facilities have to be improved in paddy farming area, in which there are still a lot of weaknesses, particularly in terms of irrigation and drainage systems, river embankment and pump houses. Floods water overflowing into paddy fields exceeding 72 hours can damage almost the entire paddy crop. If the drainage system is built in accordance with the capacity of water during the floods season the effects of floods may be reduced and thus save millions of ringgit of material input and, as a result, could increase national paddy production.

CONCLUSION

Floods and droughts have affected Malaysia's paddy production and put at risk the national food security. The government realized the impact of the disasters and takes precaution measures to reduce losses by adjusting planting schedules and using short maturation variety as effective method to reduce the impact of floods and droughts on a short-term basis. However, for long-term planning, drainage system have to be improved and short maturity paddy variety and resistance to droughts and floods have to be produced.

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