STUDY THE RELATIONSHIP BETWEEN PADDY CROP FAILURES AND RAINFALL IN MINOR TANKS: A CASE STUDY IN BAYAWA TANK

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ABSTRACT

The study was aimed at identifying the relationships between the crop failures and the rainfall events of Bayawa minor tank. Rainfall (RF) data were collected from agrarian office in Awlegama and crop failure data were collected using questionnaire surveys, referring to Kanna meeting minutes and P1 reports. RF data were analyzed using graphical and statistical methods to find the relationship of RF events to yield failures. Relationships between the total seasonal RF and the yield failures were tried to recover. Out of the past 10 seasons, the system had abandoned 2 paddy cultivation seasons. Another two seasons had reduced the cropping intensity due to bad weather conditions. Even though the tank had high water availability, farmers faced crop failures due to the impacts of variable RF events. According to the findings, yield failures had occurred due to an unexpected RF during the harvesting time as well as due to low seasonal RF. Farmers use to abandon some seasons when they experience low seasonal RF at beginning of the season. There is a relationship between the yield failures and extreme wet and dry seasonal RF conditions during the cultivation season. The yield failure in the Maha season had occurred due to both wet outlier and dry outlier conditions. In the Yala season, the system had abandoned in a dry outlier as well as during a normal RF condition.

Key words: Dry outlier, Minor tank, Seasonal rainfall, Wet outlier, Yield failure

1. INTRODUCTION

Rice is cultivated either as a rainfed or as a supplementary or fully irrigated crop [1]. The rice lands are distributed differently in three main production systems: major irrigation schemes (42%,) minor irrigation schemes (24%) and rainfed schemes (34%) [2].

The system of rice cultivation is mainly depending on the availability of rainfall (RF) and its distribution. In general, except in semi-arid areas where rice cultivation is marginal, the average RF in rice growing areas of Sri Lanka can meet at least part of the water requirement for a rice crop during its cropping season [3].

The high variability of RF may adversely affect on the rice production in some agro-ecological regions. Especially rainfed paddy cultivation comprising over 30% of all rice lands in the country are affected largely with high RF variability [4]. In the Maha season, 94.4% of the area is cultivated, but it is only 45.2 % in the Yala season [5].

In the Yala season, 80.3 % of lands under the major irrigation areas are cultivated where as it reduces to 49.8 % under minor irrigation areas and 24.8 % under rain fed areas mainly owing to water shortages [5].

Almost 100% of the cultivated areas are harvested in the Maha season since there are no water shortages. In contrast, as high as 95 % of cultivated areas are not being harvested in the drier Yala season [5]. The extent of paddy not being cultivated under minor irrigation schemes increases from 5.4 % in the Maha season to 50.2% in the Yala season mainly due to insufficient irrigation water in the minor tank systems and/or the anicut schemes [5].

In general, crop failures occur due to weather aberrations such as delayed onset of rains, early withdrawal of effective rains, and the occurrence of different degrees of drought at different stages of crop growth [6].

In this study, impacts of RF on paddy yield failures in a minor tank system were investigated.

2. METHODOLOGY

2.1 Study area

Bayawa tank area [70 69' N and 800 20' E] is situated within the agrarian service area of Awlegama in the Kurunegala district. The command area of the tank has 96 acres of paddy lands out of 584 acres of total paddy lands in the Awlegama Agrarian Service Division.

The Bayawa tank is the fourth largest tank in the Awlegama agrarian service division which consists of 96 acres of command area and 128 farmers.

2.2 Data collection

Yield failure seasons were recorded through a farmer questionnaire survey. The RF data were collected from Awlegama agrarian service centre.

2.3 Data Analysis Procedure

The monthly RF values were divided into main two cultivation seasons: Maha (September to February); Yala (March to August) according to the cultivation practices of Bayawa tank farmers and compared with recorded yield failures. The cropping calendar for the farming system, the particular rainfall event was recorded.

The extreme wet and dry outliers were derived by standardizing the seasonal RF data. Standardized values above +1 were taken as wet outliers and the values below -1 were taken as dry outliers. The relationship between the wet and dry outliers for yield failures was recovered.

3. RESULTS

Table 1 shows the overall performances including yield failure seasons within past 05 years in the system.

The average annual RF for the area is 1387 mm of which the average Yala and Maha seasonal RF are 549 and 838 mm, respectively. Figures 1 shows the RF and yield failures (1- crop failure due to RF, 2 – crop failure due to drought, 3 – abandon due to water scarcity)

Farmers tend to abandon the cultivation season even without cultivating other field crops in very low RF seasons. This situation leads to reduce the productivity in the system. Not only the Yala season, but also Maha season is sometimes affected by unexpected extreme climatic events.

There was a complete yield failure in 2010/2011 Maha season due to an unexpected RF event during the harvesting season. Daily RF for different Maha seasons with respective cropping calendar is shown in Figure 2.

Daily RF of 2011/2012 within harvesting time was further analyzed and shown in Figure 3. In 2010/2011season, there was a yield failure due to a continuous RF of 68 mm, which had fallen within 7 consecutive days with one day break.

Table 1: Overall status of seasonal performances in the command area of the Bayawa tank

Period	Season Maha(M) Yala(Y)	Cultivated			Abandoned
		Success	Failed		
			Drought	Rain	
2009/2010	M	*			
2010	Y	*			
2010/2011	M			*	
2011	Y	*			
2011/2012	M		*		
2012	Y				*
2012/2013	M	*			
2013	Y				*
2013/2014	M	*			
2014	Y	*			

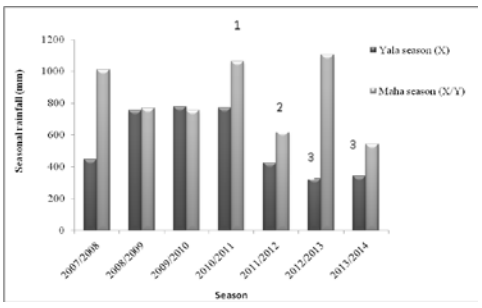

Figure 1: Yield failure seasons with seasonal rainfalls

The time period of which RF occurs within a season is much more important than the total amount of RF received with respect to yield

failures. As shown in table 2, the 2013/2014 Maha season was successful with a seasonal RF of 542 mm, but the 2011/2012 Maha season had failed with a seasonal RF of 622 mm. This situation might had occurred due to the less RF received during the crop growing period.

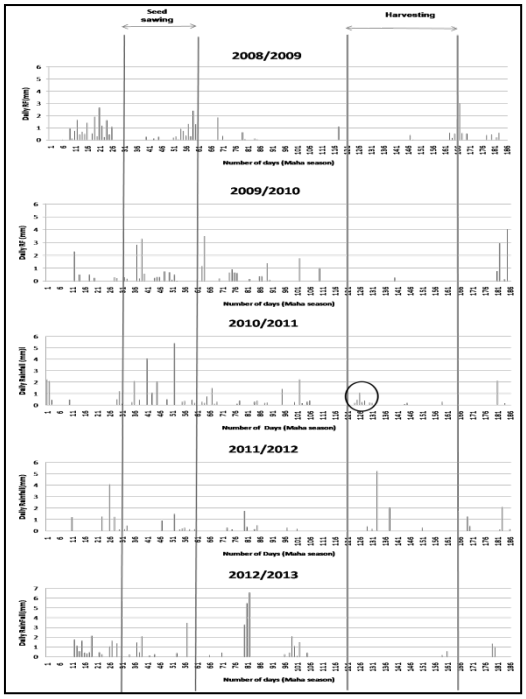

Figure 2: Daily rainfall data in Maha season with cropping practices

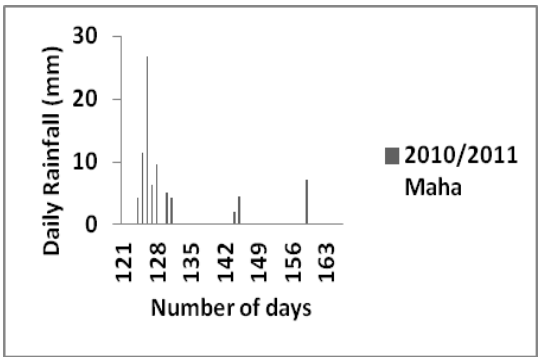

Figure 3: Daily rainfalls in harvesting time

Table 2: seasonal rainfalls in Maha season including February rainfall and without February rainfall

Month	Monthly RF (mm) 2011/2012 *Maha*	Monthly RF (mm) 2013/2014 *Maha*
RF efective period (Sep– Jan)	416	542
February(harvesting Time)	206	0
Total (Sep – Feb)	622	542

Table 3 and 4 show the relationships between the yield failures and the extreme wet and dry conditions in the Maha, and Yala seasons respectively. A yield failure due to drought in the Maha season had occurred in a dry outlier.
According to Table 4, in the Yala season, the system had abandoned in two dry outliers. These results show that if RF trends can be predicted, the decisions on abandoning a season can be possible without losing investments.

Table 3: Dry and wet outliers for past seven years in Maha season within the cultivation period

Maha Season	Condition of the Outlier	Condition of Yield failure
2007/2008	Normal	Normal
2008/2009	Normal	Normal
2009/2010	Normal	Normal
2010/2011	Normal	Yield failure (Rainfall)
2011/2012	Dry outlier	Yield failure (Drought)
2012/2013	Wet outlier	Normal
2013/2014	Normal	Normal

Table 4: Dry and wet outliers in the Yala season for past seven years

Yala season	Condition of the Outlier	Condition of Yield failure
2007	Normal	Normal
2008	Normal	Normal
2009	Normal	Normal
2010	Wet outlier	Normal
2011	Normal	Normal
2012	Dry outlier	Abandon
2013	Dry outlier	Abandon

4. CONCLUSION

Crop failures occur in the selected minor tank mainly due to unexpected RF within the harvesting time and less RF during the cultivation season. In the Yala season, farmers

abandon the season with less RF reducing the cropping intensity. Results show that yield failures have impacts from extreme climate conditions in both seasons. The yield failure in the Maha season had occurred due to both wet outlier as well as dry outlier. In the Yala season, the system was abandon in two dry outlying RF seasons. A detailed analysis is needed to find significant correlation between RF outliers and yield failures under minor irrigation systems.

5. REFERENCES

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