Research article

Control Measures for the Brown Planthopper Outbreak in Kompong Speu Province

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Abstract The aims of this research were to identify rice cropping systems and measures to control The Brown Planthopper BPH in outbreak areas in Kampong Speu province. In total, 80 households in Prey Vihear and Po Angkrong communes were randomly selected for an interview in 2008. The interviewed farmers did not grow rice all the year round and rice cultivars used were diversified. However, most cultivars are susceptible to the BPH. Moreover, Rice in early rainy season was a potential source for immigrant BPH multiplication. Almost all effective measures, both physical (mosquito net to trap insects and dispatching ducks in the fields) and chemical (Buprofezin, Fenobucarb and Denotefuran) were introduced by the Provincial Department of Agriculture (PDA). Meanwhile, the only one effective measure innovated by farmers was the application of used engine oil. However, this substance was not promoted by the PDA. No farmer lost rice completely in the outbreak year because all households possess small fragmented paddy fields in three different agro-ecosystems, so the periods of transplanting and growing were also different.

Keywords brown planthopper, rice production, outbreak, cropping system

INTRODUCTION

The Brown Planthopper (BPH) was considered as one of the major threats to rice production in Asia in the seventies and eighties. Through the integrated pest management (IPM) program, field schools, insecticide reduction campaigns, and policy changes to reduce the use of pesticides, the BPH has been contained for many years (Heong, 2009). Subsequently, entomological research and planthoppers began to receive lesser attention (Heong, 2008). Since 2005, planthopper outbreaks have affected several million hectares of rice land in countries such as Vietnam, China, Indonesia, Korea, Japan and Malaysia (Heong, 2008; IRRI, 2010).

Many approaches and measures were developed to control BPH based on availability of technology and geography. Ecological field studies, light trap catches and predictive modeling have indicated the possibility of movements within the tropics but the pattern of movement and the separation of migrants from the endemic population have proved to be more difficult to establish (Pender, 1994). Rombach and Gallagher (1994) showed a detailed record of the breakdown of four resistant genes during Philipine Rice Self-sufficiency program.The evolution of chemical control of the BPH is exemplified in some experiences in Japan. The use of whale oil was found to be effective in 1670 and then kerosene began to replace whale oil in 1897 (Suenaga and Nakatsuka, 1958; Matsuo 1961). DDT dust was the first post- World War II insecticide to replace kerosene and it was soon replaced by BHC and after that many insecticides were developed and replaced the old ones (Matsuo, 1961). In tropical regions between 1967 and 1979, BPH developed resistance to several insecticides, including: carbaryl, metolcarb, isoprocarb, malathion, diazinon, and fenitrothion (Heinrichs, 1994).From 1999 to 2000, BPH increased its resistance to malathion, etofenprox and imidacloprid (Nagata *et al.,* 2001). Oka (1979) suggested synchronized planting and crop rotation as a measure to control BPH. However, it is socially unacceptable even if it might be technically useful. The interactions between planthoppers and their natural enemies are believed to be the major factor when controlling the pattern of population growth (Wada *et al.,* 1991). A new approach called 'ecological engineering' was proposed in the aims to reestablish essential ecosystem services through increasing local biodiversity in rice production systems (Heong, 2009).

In Cambodia, before 1984, BPH was a secondary pest. Since then, BPH was epidemic almost everywhere especially the provinces along the Vietnamese border (Heng, 1996). The government began documenting pest outbreaks in 1991 and then BPH outbreak occurs every year (Preap, 2005). In 1996, BPH was recognised to be the main rice insect pest. At that time, some pesticides such as Applaud (Buprofezin), Trebon 10 EC (Ethofenprox), Bassa (Fenobucarb or BPMC), Mipcin (Isoprocarb) were recommended for controlling BPH in 1990s. These pesticides have different effect on BPH and suit to different rice growth stage and certain environmental condition and have less effect on natural enemies (Heng, 1996). To date, Buprofezin are sold in Cambodia under different trade names such as: Lobby 25WP, Apolo 25WP, Butyl 10WP, Asmai 250WP, Applaud 10WP, Pajero 30WP and Ten Cong (Pel, 2009).

Outbreak history of BPH in the Cambodian rice agro-ecosystem was well-compiled from Agronomy Department records by Preap (2005) and he also concluded that the outbreaks were localized and patchy within a field. However, control measures for BPH outbreaks have not been well-documented, particularly at the grass-root level. The aims of this research were to identify rice cropping systems and measures to control BPH in outbreak areas in Kampong Speu province.

METHODOLOGY

Two communes in Kompong Speu province were selected based on administrative borders, where the largest cropped area was infected and/or damaged by BPH outbreak in 2007 (DAALI, 2007), using hierarchical order from provincial to village level. The studied villages were, firstly, scored by the level of damages by heads of agriculture offices of both communes. In total, 80 households in Prey Vihear and Po Angkrong communes were randomly selected for an interview in 2008.The data collection was conducted in three phases. Firstly, the semi-structure was used to interview key informants or persons at different levels to identify the rice production areas affected by BPH outbreak and issues related. Secondly, a structured questionnaire was elaborated to interview individual farmers. Chemical and physical methods used by farmers and their perceptions of the effectiveness of the methods were provided by them based on their own experiences. Thirdly, analyzed data were rechecked and confirmed by key informants or persons at different levels. Data were coded and processed in Microsoft Excel 2003 software and exported to SPSS version 13.

RESULTS AND DISCUSSION

The number of farmers growing early rainy season rice in Po Angkrong was higher than in Prey Vihear.

In both communes, there was a slight increase in the number of households growing this kind of rice (Table1). It may be influenced by high rice price in the local market.

Every household in both communes normally grow three rice cultivars because all households possess small fragmented paddy fields in three agro-ecosystems. The data in Table 2 illustrates the various rice varieties in Prey Vihear and Po Angkrong commune. Percentage of each variety name, as it is called by local people, was calculated from multiple answers of each respondent. The varieties used by farmers in both communes were quite diverse and different from each other, but some varieties were grown in both regions. In Prey Vihear, farmers nearly grew traditional varieties among which Chmar Prum was easily the most popular. The other like Chamroeun Phal, Kum Ampoa, Kong Sor and Neang Malis were slightly used. Conversely Chmar Prum was not the most frequent used of farmers in Po Angkrong where there were four important varieties including CAR 9 and Raing Chey, which are the improved varieties released by the Variety Recommendation Committee of Cambodia (VRC), as well as two modern varieties, IR62 and IR42. The rests were Senpidor and Raing Chey, also released by VRC and Kabor, the local variety. Most cultivars are susceptible to BPH.

Table 1 Early rainy season rice from 2006 to 2008 in Prey Vihear and Po Angkrong

Early wet season rice	Prey Vihear		Po Angkrong	
	frequency	%	frequency	%
2006	1	2.50	5	12.50
2007	1	2.50	5	12.50
2008	2	5.00	6	15.00

Table 2 Rice varieties used in Prey Vihear and Po Angkrong commune

Variety name	Prey Vihear		Po Angkrong	
	frequency	(%)	frequency	(%)
Ath Chhnos **	2	4.26	1	1.16
CAR9 *	-	-	16	18.60
Cham Roeun Phal	4	8.51	14	16.28
Chmar Prum **	24	51.06	-	-
IR42	-	-	1	1.16
IR62	-	-	1	1.16
Kabor	1	2.13	8	9.30
Kong Kaboth	-	-	1	1.16
Kong Sor	4	8.51	11	12.79
Kra Hom **	2	4.26	13	15.12
Kum Ampao	4	8.51	-	-
Neang Malis	4	8.51	7	8.14
NeangKheng	1	2.13	-	-
Pork Lolok	-	-	1	1.16
Pram Bei Kour	1	2.13	-	-
Raing Chey *	-	-	7	8.14
Sen Pidor	-	-	5	5.81
Total	47	100.00	86	100.00

** Susceptible cultivar (Men et al., 2001); ** susceptible cultivar (Preap, 2005)*

There was a high difference in the number of farmers using agro-chemicals against BPH in the communes. Farmers in Prey vihear commune used fewer agro-chemicals to kill BPH than ones in Po Angkrong, 20% and 77.50% respectively (Table 3), because Po Angkrong was more seriously infested. Agro-chemicals given by The Provincial Department of Agriculture PDA and Oshin 20WP (Denotefuran) were commonly used by farmers. PDA provided agro-chemicals named Bassa 50EC (Fenobucarb), Butyl 10WP (Buprofezin) and Map Judo 25WP (Buprofezin) to control BPH. The two former insecticides were provided by MAFF and Map Judo 25WP (Buprofezin) was provided by An Giang province, Vietnam. Fenobucarb has been used for rice planthopper control in Asia for the last 30 years and it is still in use nowadays. Sriratanasak et al. (2010) reported that there is a different resistance to Fenobucarb from populations of BPH in Philipine, Thailand and China. The BPH population in China was the most resistant, about 53 times and 25 times higher than population in the Philippines and Thailand, respectively. In China, 28-fold resistance to Buprofezin (in comparison to 2004) was observed. So BPH has the potential to develop high resistance to buprofezin (Wang *et al.,* 2008). Wang *et al.,* (2008) proposed a resistance