

Knowledge, Attitude, Awareness, Communication and Practice among Farmers towards Empowerment of Natural Enemies in Rice Field in Melaka, Malaysia

Fairuz, K.^{a,b}, Idris, A. G.^a, Syahrizan, S.^b and Mohammad Noor, A. H.^b

^aSchool of Environment and Natural Resources Sciences, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia

^bFaculty of Plantation and Agrotechnology, Universiti Teknologi MARA, Melaka Branch, Jasin Campus, Jalan Lembah Kesang 1/1-2, Kampung Seri Mendapat, 77300 Merlimau, Melaka, Malaysia

DOI: 10.6007/IJARBSS/v7-i11/3560 URL: <http://dx.doi.org/10.6007/IJARBSS/v7-i11/3560>

Abstract

Rice is a staple food in Malaysia and contributes 8.9% of the national gross domestic product in 2015. The productivity has increased from time to time in order to meet the high demand now days. The use of pesticides technology was widely used the rice production all over Malaysia due to the prompt results of combating pests. The heavy usage of pesticides has led to the pollution of the ecosystem including the beneficial insects. Decision of spraying was made by the farmer themselves which were influenced by their knowledge, attitude, awareness and communication regarding the presence of natural enemies in their rice field. However, these factors has not been measured properly in order to determine their significance towards the farmers practice. Hence, a survey has been conducted to determine the proposed measurement in rice farming area in Melaka. Farmers from three main rice farming area were interviewed using questionnaire as the main instrument. The questionnaire has been pretested prior to the actual survey. A total of 224 farmers were sampled out of 860 rice farmers' population throughout Melaka. Data were analyzed for their central tendencies as well as significant relationship. Result showed that knowledge, attitude and communications has given a significant effect to the farmers' practices towards enhancing the natural enemies in rice fields. However, the findings also found that the awareness level is inadequate among farmers. Therefore, there is a need for continuous awareness program by the local authorities regarding the natural enemies in the rice field in the future.

Keywords: Rice, Farmers, Knowledge, Attitude, Awareness, Communication, Practice, Natural enemies, Melaka, Malaysia.

Introduction

In general, the Gross Domestic Product (GDP) of Malaysia's agricultural sector contributes 8.9 percent in 2015. As a staple food, rice production of Malaysia has increased up to 473,000 tons (16.6%) in 2015 compared to others. From this, with the average yield of 3.52 tons per hectare, rice production in Malacca was recorded at 9,011 metric tons planted 2,565 hectare in 2015

(Anon, 2016). Previous rice farming purpose is more towards the local community consumptions. With the average of 3 acres of land, farmers were actively running the rice farming with the average production is about 1 to 2 tons per acre. However, due to the rapid population growth, the demand of food supply in recent years has increased, especially for rice productivity (Dzobo, 2016). This has been a strong motivation for the farmers to the increase their production in order to cater the issue. The use of new technology has been very much helpful including the use of pesticides technology in rice farm (Popp, Peto, & Nagy, 2013; Ranjan et al., 2014; Sagoff, 2011). The extensive usage of pesticide in rice field is still the most preferred method to avoid pest population due to its prompt results. However in long term, it can affect the natural resources, environment and rice ecosystem including the beneficial insect (Norazliza, Mohd Rasdi, Fauziah, Fairuz, & Ismail, 2014; Schoenly et al., 2003) such as spiders (Hafiz, Abida, & Sher, 2009), crickets (Lee et al., 2002), mirid bug (Takada, Yoshioka, Takagi, Iwabuchi, & Washitani, 2012), dragon flies (Ameilia Zuliyanti, Che Salmah, & Zulkifli, 2010) and many others.

In order to achieve the goal of becoming a Green State to empower the green technology in all activities in the state by the year 2020 (Suffian, 2015), Melaka state has been encouraging the use of green technology as a long term investment for agricultural activities particularly among rice farmers. The advantage of green technology is that, it can help preserving the natural enemies and other beneficial insects in the rice field. Natural enemy is one of the important components in the integrated pest management (IPM) programs. Natural enemy refers to the living thing that can reduce the population of pest and disease by means of predation and egg parasitizing (Fuad et al., 2012). Many researchers has been highlighting the importance of natural enemies to the rice productivity (Shui-chen, 1979) and it is very essential for the farmers to understand the purpose of natural enemies in their field (Mohd Hanysyam et al., 2013; Norazliza et al., 2014). Farmers should have equipped themselves with a better understanding of the effects of the chemical to the natural enemies since it will influence the decision made by them. This should also not limited to the aim of immediate results and maximizing the profit.

The knowledge, attitude, awareness, communication and practice of rice farmers should be at their best in order to conform to the related issue. KAP Model is one of the popular method to measure the level of knowledge, attitude and practice of participant in a survey. It has been used in many study area such as health science (Shafie & Azman, 2015; ul Haq et al., 2013), environmental science (Ahmad, Noor, & Ismail, 2015) and also agriculture (Lekei, Ngowi, & London, 2014; Mohsen, Salah, Mohamed, & Hafez, 2016; Wongwichit, Siriwong, & Robson, 2012). On the other hand, other dimension such as communication (Ahmad et al., 2015; Soola, 1988; Wu, Parnwell, & Bradley, 2002) and awareness (Dhakal et al., 2014; Yang et al., 2014) are also important to be included. Knowledge can be defined as the capacity to acquire, retain and use information. It is also a mixture of comprehension, experience, discernment and skill (Bergeron, 2011). Attitude on the other hand refers to inclinations to react in a situation. Awareness however, is an ability to combine sense from the environment. It also related to the

knowledge and attitudes of a persons that will influence a person to make decision whereas to increase or not to increase the level of performance. Communication proficiencies can benefits to individuals' social and participation in fulfilling interpersonal relationships. Communication also contribute towards improving the critical thinking, criticism and leadership skill. By Practice which means the application of instructions and knowledge that leads into real action. Nevertheless, the level of understanding in terms of knowledge, attitude, awareness, communication and practice on the natural enemies among rice farmers in Melaka were not well documented and described. Thus a survey was conducted in order to determine the level of knowledge, attitude, awareness, communication and practice on the natural enemies among farmers in Melaka.

Methodology

The study was carried out to determine the farmer`s knowledge, attitude, awareness, communication and practice towards enhancing the natural enemies in their rice fields. The location was decided to be done at the three rice production areas of Melaka state which were Jasin, Melaka Tengah and Alor Gajah. Duration of sampling was performed from August to December of 2016. This study was associated with Farmers' Association of Melaka and the Department of Agriculture of Melaka who is responsible for paddy development in those three areas. The population selected for this research consisted of independent rice farmers which were actively working on the paddy production. Stratified random sampling were done from three rice production areas. Total population of rice farmers in Melaka was 860 in those three areas. Since the population size has been identified, the number of sampling was determined using the sampling table provided by Krejcie & Morgan, 1970 at 5% error. Number of samples determined for this study was 265 farmers, however, only 224 or 84.5% of questionnaire were analyzed due to the absence of some respondents and incomplete answers.

A set of questionnaire was prepared for the purpose of this study. The questionnaire was adopted and adapted based on the guidelines and recommendations regarding natural enemies done by previous study (Escalada & Heong, 1997; Heong & Escalada, 1997; Nguyen, Medina, Velasco, & Dizon, 2011) as tabulated in Table 1. The content of the questionnaire were also include 1) socio-demographic information; 2) knowledge dimension; 3) attitude dimension; 4) awareness dimension; 5) communication dimension; and 6) practice dimension. Likert scale with 9 levels ranging from 1 for "strongly disagree" to 9 for "strongly agree" were used to measure the respondent's level of agreement. Furthermore, farmers also being asked on their belief on the effect of natural enemies after pesticides spraying has been carried out. After the translation to Bahasa Malaysia from the standard questionnaire it was distributed among the respondents to get the necessary information. The study was carried out using a pretested with 20 individuals (Hair, Money, Samouel, & Page, 2007) and modified questionnaire.

Table 1: Summary of questionnaire source.

No.	Variable	Construct	Number of Item	Reference
1	Independent	Knowledge	4	(Assis & Mohd Ismail, 2011; Heong, Escalada, Sengsoulivong, & Schiller, 2002)
2		Attitude	4	(Assis & Mohd Ismail, 2011)
3		Awareness	6	(Abdollahzadeh, Sharifzadeh, & Damalas, 2015; Terano, Mohamed, Shamsudin, & Latif, 2015)
4		Communication	5	(Heong, Escalada, Huarp, & Map, 1998)
5	Dependent	Practice	3	(Assis & Mohd Ismail, 2011)

In the demographic section, the respondent were asked to provide their personal information such as age, gender, education level, experience in rice planting, variety of rice planted, size of rice field and average yield per hectare. In the knowledge dimension the respondent were asked whether the farmers' know about the presence and functions of natural enemies in the field. The effect of chemical spraying to the natural enemies also being asked. The attitude however, the questions were regarding whether the farmers seriously wanted to empower the population of natural enemies in the field. Awareness dimension focused on the aspects whether the farmers have attended any trainings and workshops, updating information from the social media regarding the natural enemies and starting to make changes. In the communication dimension, the respondent were asked whether the farmers have been communicating with other people, always referring to the extension officer, sharing info with family and friends as well as the agricultural input suppliers about the presence of natural enemies. While in the practice dimension, the respondent need to response whether they have initiated any reduction in the use of pesticides and making self-inspection of natural enemies' population in the field. The relationship of the studied dimensions was as illustrated in the measurement model (Figure 1). Data collected were analyzed for their means, frequencies, standard deviation and percent from the farmers' demographic traits. Meanwhile, the knowledge, attitude, awareness, communication and practice dimensions data were measured for their consistency and significant relationship using reliability, correlation and multiple regression analysis. Significant relationship was set at the probability level of 0.05. All data analysis were performed using IBM-SPSS ver.22.

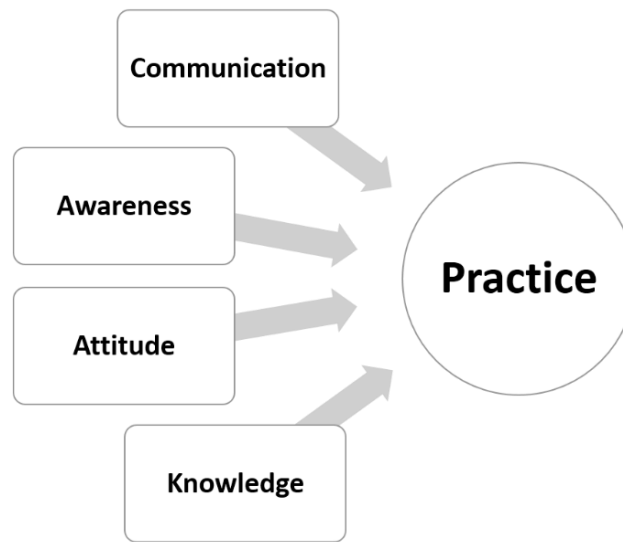


Figure 1: Measurement model of study.

Results and Discussion

From the result, it was found that male farmers were dominant in Melaka with 94.6% compared to female (Table 2). The average size of rice farm in Melaka was 0.93 hectare per farmer with an average yield of 4.52 tons per hectare per planting season. In this study, it was found that most (92.9%) of rice farmers in Melaka were using CL220 variety as planting material and only 7.1% of farmers were using MR220 variety. In the meantime, it was found that 54.0% of rice farmers were in the group of 51-60 years old followed by 28.6% of farmers above 60 years old. Farmers within 41-50 years consist of 16.5% and only 0.9% of farmers were below 40 years of age. In terms of education level, 84.4% of farmers attended up to secondary school, while 15.2% attended primary school and only 0.4% can reach up to higher education level. All farmers were also found practicing 1-3 times of pesticide spraying per planting season as recommended by the department of agriculture.

Table 2: Demographic of respondent.

Respondents' Demographic	Group	Frequency	Percentage (%)
Planted paddy varieties	CL220	208	92.9
	MR220	16	7.1
Age	31-40 years	2	0.9
	41-50 years	37	16.5
	51-60 years	121	54.0
	Above 60 years	64	28.6
Gender	Male	212	94.6
	Female	12	5.4
Education level	Secondary School	189	84.4
	Primary School	34	15.2
	Higher Education Institute	1	0.4

In the question of farmers' belief on natural enemies has discovered that, 52.7% of rice farmers in Melaka do not know the activities of natural enemies in their rice field. 44.6% of farmers believed that the natural enemies were occupying on leaves or live in the field. Only 2.7% of farmers believed that natural enemies were eating other insects. On the other hand, 52.2% of farmers believed that natural enemies will die after pesticide spraying and 47.8% of farmers believed that natural enemies will disappear after pesticide spraying. All items were acceptable since the Cronbach's alpha value were greater than 0.6 and the lowest corrected item in total correlation was 0.411 (Table 3). This indicated that the questionnaire is reliable to the targeted respondent. The farmers seem to understand the questions and they also able to identify the differences between all questions requirement. The model summary for the multiple regression analysis were as shown in Table 4. Significant effect were shown by the knowledge ($P=0.003$), attitude ($P=0.000$) and communication ($P=0.000$) dimension. Non-significant result was shown by the awareness ($P=0.739$) dimension.

Table 3: Reliability statistics of the studied dimension.

Construct	Number of items	Cronbach's Alpha	Lowest Corrected Item-Total correlation
Knowledge	4	0.864	0.615
Attitude	4	0.660	0.411
Awareness	6	0.789	0.502
Communication	5	0.879	0.661
Practice	3	0.682	0.435

This study will help to provide a baseline data of trends of knowledge, attitudes, awareness, communication and practice regarding natural enemies of rice pests among farmers in Melaka. This will also help in assessing the suitability and adequacy of rice farmers'

community awareness campaign and training needs in the future. The study has found that most of farmers were belong to the group age of 51-60 years old. This might be due to the migration of youngster to the city to find a better paid salary and much more exclusive lifestyles. Furthermore, at this age, most farmers have lost their motivations to attend any courses or training to learn new knowledge. They probably think that they have enough knowledge and attending another one is just a waste of time. Majority of farmer were found attending up to the secondary school. Most of the farmer cannot afford to go to the tertiary education due to low income of rice productivity which was not enough to support the fees and other expenditures. They only managed to go to the government funded school. This is critical scenario that the local authorities need to take into account. Something need to be done to attract the young people to work in the rice field. Most farmers were found to plant the variety of CL220 rice in their field. This variety is recommended by the DOA to be planted because of the high yield and resistant to common diseases. Moreover, it is easier to plant the same varieties in order to synchronize with the life cycle of the variety and on-site planning such as watering, field up-keep as well as mechanization schedule for planting and harvesting.

Table 4: Coefficients between independent variable and dependent variable (practice).

Variable	Standardized beta	P value	F	R ²	Adjusted R ²
Knowledge	-0.208	0.003**	37.029	0.403	0.393
Attitude	0.680	0.000**			
Awareness	-0.022	0.739 ^{ns}			
Communication	0.317	0.000**			

*Significant (P<0.05), **Highly Significant (P<0.01) & ns: not significant

All farmers were found practicing 1-3 times of pesticide spraying per planting season as recommended by the department of agriculture. This practices will reduce the chances of rice pests being resistant to the chemical and also help the natural enemies to sustain in the field for a longer period. This study has found that at least half of the farmers' population still did not have any idea the function of natural enemies in the rice field. This also shows that the awareness of farmers is still low and need to be taken into consideration by the local authorities seriously. Even though all the farmers have good knowledge and experience in paddy farming, but the farmers do not aware about the functions of the natural enemies in their fields. This may be because of farmers were taking for granted from the information given and also might be due to barely attending programs that had been establish by the local authorities to discuss about the issues. Many findings found that farmers' expectation in getting higher yield were also influence their beliefs. Nevertheless, unnecessary spraying activities is also related to the noncompliance to the recommended dosage by the department of agriculture. Since the majority of farmers were in the senior citizen group (above 50 years old), they were most likely reluctant to attend any training or campaign. This may be due to their health condition and lack of motivation to make a change. Hence, a new strategy to attract younger people to work in agricultural industry need to be discussed and developed.

Conclusion

Based on the above findings, it can be concluded that knowledge, attitude and communications gave a significant effect to the practices of the farmers towards enhancing the natural enemies in rice fields. The findings of the study shows that awareness level is inadequate among farmers and need more attentions by the farmers as well as the local authorities. It can influence the practice of farmers in the field. There is a need for continuous awareness program by the local authorities regarding the natural enemies in the rice field. Further studies are needed in large scale to corroborate above findings.

Acknowledgement

The author want to thank to the Department of Agriculture, Melaka and Farmers' Association of Melaka for their assistance and guidance in this study.

Correspondent Author

Fairuz Khalid, Department of Plantation Management and Agribusiness, Faculty of Plantation and Agrotechnology, Universiti Teknologi MARA, Melaka Branch, Jasin Campus, Melaka, Malaysia, dpim18g@gmail.com

Reference

- Abdollahzadeh, G., Sharifzadeh, M. S., & Damalas, C. A. (2015). Perceptions of The Beneficial and Harmful Effects of Pesticides among Iranian Rice Farmers Influence The Adoption of Biological Control. *Crop Protection*, 75, 124–131. <https://doi.org/10.1016/j.cropro.2015.05.018>
- Ahmad, J., Noor, S. M., & Ismail, N. (2015). Investigating Students' Environmental Knowledge, Attitude, Practice and Communication. *Asian Social Science*, 11(16). <https://doi.org/10.5539/ass.v11n16p284>
- Ameilia Z, S., Che Salmah, R., & Zulkifli, N. (2010). Abundance and Diversity of Odonata in Upland Rice Field at Manik Rambung, North of Sumatera. In *7th IMT-GT UNINET and the 3rd International PSU-UNS Conferences on Bioscience* (pp. 55–61).
- Anon (2016). *Selected Agricultural Indicators, Malaysia. Department of Statistics Malaysia*. Retrieved from https://www.dosm.gov.my/v1/index.php?r=column/cthemByCat&cat=72&bul_id=QS95em5KdjhRUDZzZzJXdEtONFhXdz09&menu_id=Z0VTZGU1UHBUT1VJMF1paXRRR0xpdz09
- Assis, K., & Mohd Ismail, H. A. (2011). Knowledge, Attitude and Practices of Farmers towards Organic Farming. *International Journal of Economics and Research*, 2(3), 1–6.
- Bergeron, B. (2011). Knowledge Management. *Management*, 30, 89–93. <https://doi.org/10.1186/1752-0509-5-38>
- Dhakal, S., Joshi, D. D., Ale, A., Sharma, M., Dahal, M., Shah, Y., & Stephen, C. (2014). Regional Variation in Pig Farmer Awareness and Actions Regarding Japanese Encephalitis in Nepal: Implications for Public Health Education. *PLoS ONE*, 9(1). <https://doi.org/10.1371/journal.pone.0085399>

- Dzobo, A. (2016). *Knowledge, Practices and Self - Reported Symptoms of Pesticides Use among Vegetable Farmers: A Cross Sectional Study in the Offinso North District*. University of Ghana.
- Escalada, M. M., & Heong, K. L. (1997). Changing Farmers' Perceptions of Pests through Participatory Experiments. *ILEIA Newsletter*, 13(2), 10–12.
- Fuad, M. J. M., Junaidi, A. B., Habibah, A., Hamzah, J., Toriman, M. E., Lyndon, N., & Azima, A. M. (2012). The Impact of Pesticides on Paddy Farmers and Ecosystem. *Advances in Natural and Applied Sciences*, 6(1), 65–70.
- Hafiz, M. T., Abida, B., & Sher, M. S. (2009). Foraging Strategies and Diet Composition of Two Orb Web Spiders in Rice Ecosystems. *The Journal of Arachnology*, 37, 357–362.
- Hair, J. F., Money, A. H., Samouel, P., & Page, M. (2007). *Research Methods for Business*. John Wiley & Sons.
- Heong, K. L., & Escalada, M. M. (1997). Pest Management Perceptions and Practices of Farmers Growing Rice and Vegetables in Nueva Ecija, Philippines. In K. L. Heong & M. M. Escalada (Eds.), *Pest Management of Rice Farmers in Asia* (pp. 161–170). Los Baños, Philippines: International Rice Research Institute.
- Heong, K. L., Escalada, M. M., Huarp, N. H., & Map, V. (1998). Use of Communication Media in Changing Rice Farmers' Pest Management in the Mekong Delta, Vietnam, 17(5), 413–425.
- Heong, K. L., Escalada, M. M., Sengsoulivong, V., & Schiller, J. (2002). Insect Management Beliefs and Practices of Rice Farmers in Laos. *Agriculture, Ecosystems and Environment*, 92(2–3), 137–145. [https://doi.org/10.1016/S0167-8809\(01\)00304-8](https://doi.org/10.1016/S0167-8809(01)00304-8)
- Krejcie, R. V., & Morgan, D. W. (1970). Determining Sample Size for Research Activities. *Education and Psychological Measurement*, 30, 607–610. <https://doi.org/10.1177/001316447003000308>
- Lee, G.-H., Heong, K. L., Paik, C.-H., Kim, D.-H., Na, S.-Y., & Choi, M.-Y. (2002). Life Cycle and Predation Potential of the Black Cricket, *Methioche vittaticollis* (Orthoptera: Gryllidae) and Its Population Density in the Rice Field. *Journal of Asia-Pacific Entomology*, 5(2), 215–220. [https://doi.org/10.1016/S1226-8615\(08\)60155-7](https://doi.org/10.1016/S1226-8615(08)60155-7)
- Lekei, E. E., Ngowi, A. V., & London, L. (2014). Farmers' Knowledge, Practices and Injuries Associated with Pesticide Exposure in Rural Farming Villages in Tanzania. *BMC Public Health*, 14(1), 389. <https://doi.org/10.1186/1471-2458-14-389>
- Mohd Hanysyam, M. N., Fauziah, I., Siti Khairiyah, M. H., Fairuz, K., Mohd Rasdi, Z., Nurul Zfarina, M. Z., & Norazliza, R. (2013). Entomofaunal Diversity of insects in FELDA Gunung Besout 6, Sungkai, Perak. In *IEEE Business Engineering and Industrial Applications Colloquium (BEIAC 2013)* (pp. 234–239). Langkawi, Malaysia: IEEE. <https://doi.org/10.1109/BEIAC.2013.6560123>
- Mohsen, M. M., Salah, R., Mohamed, E., & Hafez, S. H. (2016). Knowledge, Practice and Self-reported Symptoms among Farmers about Hazards of Pesticide Exposure. *International Journal of Novel Research in Healthcare and Nursing*, 3(2), 143–154.

- Nguyen, D. T., Medina, C. D. R., Velasco, L. R. I., & Dizon, J. T. (2011). Farmers' Knowledge and Practices in Controlling Mites and Their Attitude towards Biological Control. *Korean J. Intl. Agri.*, 23(1), 7–20.
- Norazliza, R., Mohd Rasdi, Z., Fauziah, I., Fairuz, K., & Ismail, R. (2014). Water Quality, Climatic and Plant Traits as Predictors on Abundance of Insects in Paddy Field, Tanjung Karang, Selangor, Malaysia. *Journal of Agricultural Science and Technology B*, 4, 641–651. <https://doi.org/10.17265/2161-6264/2014.08.006>
- Popp, J., Peto, K., & Nagy, J. (2013). Pesticide Productivity and Food Security. A Review. *Agronomy for Sustainable Development*, 33(1), 243–255. <https://doi.org/10.1007/s13593-012-0105-x>
- Ranjan, R., Neupane, K., Wantamutte, A. S., Banjade, B., Kushwaha, N., Neupane, R., & Mph, P. G. (2014). Practice of Pesticides Use among the Farmers of Kangrali Village in Belgaum - A Cross-sectional Study. *International Journal of Interdisciplinary and Multidisciplinary Studies*, 1(5), 202–207.
- Sagoff, M. (2011). The Quantification and Valuation of Ecosystem Services. *Ecological Economics*, 70, 497–502. <https://doi.org/10.1016/j.ecolecon.2010.10.006>
- Schoenly, K. G., Cohen, M. B., Barrion, A. T., Zhang, W., Gaolach, B., & Viajante, V. D. (2003). Effects of *Bacillus thuringiensis* on Non-Target Herbivore and Natural Enemy Assemblages in Tropical Irrigated Rice. *Environ. Biosafety Res.*, 3, 181–206. <https://doi.org/10.1051/ebr:2003013>
- Shafie, A. A., & Azman, A. W. (2015). Assessment of Knowledge, Attitude and Practice of Food Allergies among Food Handlers in the State of Penang, Malaysia. *Public Health*, 129(9), 1278–1284. <https://doi.org/10.1016/j.puhe.2015.03.016>
- Shui-chen, C. (1979). Biological Control of the Brown Planthopper. In *Brown Planthopper: Threat to Rice Production in Asia*. (pp. 335–355). International Rice Research Institute, Manila, Philippines.
- Soola, E. O. (1988). Agricultural Communication and the African Non-Literate Farmer: The Nigerian Experience. *Africa Media Review*, 2(3), 75–91.
- Suffian, A. B. (2015). Melaka Step Forward in Green Technology. Retrieved from <http://www.utusan.com.my/berita/wilayah/melaka/melaka-maju-selangkah-dalam-teknologi-hijau-1.76040>.
- Takada, M. B., Yoshioka, A., Takagi, S., Iwabuchi, S., & Washitani, I. (2012). Multiple Spatial Scale Factors Affecting Mirid Bug Abundance and Damage Level in Organic Rice Paddies. *Biological Control*, 60(2), 169–174. <https://doi.org/10.1016/j.biocontrol.2011.11.011>
- Terano, R., Mohamed, Z., Shamsudin, M. N., & Latif, I. A. (2015). Factors Influencing Intention to Adopt Sustainable Agriculture Practices among Paddy Farmers in KADA, Malaysia. *Asian Journal of Agricultural Research*, 9(5), 268–275. <https://doi.org/10.3923/ajar.2015.268.275>
- ul Haq, N., Hassali, M. A., Shafie, A. A., Saleem, F., Farooqui, M., Haseeb, A., & Aljadhey, H. (2013). A Cross-Sectional Assessment of Knowledge, Attitude and Practice among Hepatitis-B Patients in Quetta, Pakistan. *BMC Public Health*. <https://doi.org/10.1186/1471-2458-13-448>

- Wongwichit, D., Siriwong, W., & Robson, M. G. (2012). Herbicide Exposure to Maize Farmers in Northern Thailand: Knowledge, Attitude, and Practices. *Journal of Medicine and Medical Sciences*, 3(1), 34–38.
- Wu, B., Parnwell, M., & Bradley, P. (2002). Farmer Self-Organizing Innovation in the Marginal Areas of China: A Study of Farmer Communication Networks in Zhidan, Loess Plateau. *Journal of Rural Cooperation*, 30(1), 43–63.
- Yang, X., Wang, F., Meng, L., Zhang, W., Fan, L., Geissen, V., & Ritsema, C. J. (2014). Farmer and Retailer Knowledge and Awareness of the Risks from Pesticide Use: A Case Study in the Wei River Catchment, China. *Science of the Total Environment*, 497–498, 172–179.
<https://doi.org/10.1016/j.scitotenv.2014.07.118>