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WEED RESEARCH IN ASEAN COUNTRIES: AN ANNOTATED BIBLIOGRAPHY

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ABSTRACT – Problems on weeds in the ASEAN countries have been a major concern through the years. Its impact on agriculture, humans and the environment led to increasing demand for research studies. Weed literature, including ecological and taxonomic studies, were collected to determine if weed problems were assessed and addressed the holistic way. The trend of weed research in the ASEAN region was reviewed and annotated. There were a total of 233 literature noted and the distribution in each country was as follows: Brunei (5), Cambodia (9), Indonesia (34), Laos (10), Malaysia (46), Myanmar (5), Philippines (49), Singapore (13), Thailand (49), and Vietnam (13). It was observed that many research works on weeds in the ASEAN countries focused on weed management due to the increasing need for more effective management practices, solving problems on herbicide resistance and yield reduction. However, a holistic assessment of the current weed problems led to more weed ecological studies in past 15 years. Weed research in the next 10 years has to be more concerned with sustainable ways in dealing with weed problems, emphasizing weed ecology and taxonomy as well.

Keywords: ASEAN, annotated weed literature, ecology, taxonomy, weed management

INTRODUCTION

Agriculture has been an important part of the growing economy of the Association of Southeast Asian Nations (ASEAN), comprising Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. Member countries are known for its high agricultural productivity and export industry but with varying contribution of agriculture in the gross domestic product (GDP) (Bello, 2005). However, several problems on production, primarily by weeds, are faced in the region.

Weeds have a great impact in agriculture, human activities and the environment. Problems related to yield losses and herbicide resistance were observed (Mutert and Fairhurst, 2002). Weeds may also affect biodiversity and yield due to weed invasion (Adair and Groves, 1998), and as alternate hosts of insects and pathogens (Norris and Kogan, 2000). Since agricultural fields are usually monocropped, weeds can easily invade the area (Tracy *et al*., 2004). In humans, weeds may induce allergies due to pollen or upon contact with the plant, and weeds as source of fire hazards and poisons. These problems were mostly consequences of mistaken identity, accidental introduction, poor management practices and other human activities (Zimdahl, 2007). Most of the research works on weed science in the ASEAN countries are focused on weed management. Positive impact of weeds on reforestation, ecosystem and land conservation have not been not taken into account. Nonetheless, weed problems that occurred before are still unresolved. The assessment of problems may be inadequate and a holistic approach on weed studies is needed. In this study, weed studies in ASEAN countries were gathered and annotated.

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The objective of this study was to identify the direction of weed research in the region in the past and for the next 10 years. This could be used as reference in future weed studies related to weed identification and ecology, and development of holistic and sustainable management strategies.

METHODOLOGY

Weed journals and books published from 1960 to present were used as reference for the listed literature in this study. Research works were compiled based on the location of reference. The listing of literature was grouped into two main parts: country-based and general weed literature. Annotations were written to provide an idea on what the paper is all about. A brief summary on the status of weed research in each country was also provided. The collated weed studies were interpreted based on the number of publications in each ASEAN member country, and based on four major classifications of the researches (weed management, ecology, taxonomy, and interspecific interaction). Also, the trend of weed research, in the ASEAN region, through the years was determined and the possible direction of weed studies in the next ten years was assessed.

RESULTS AND DISCUSSION

The following is a listing of the published weed literature with annotations arranged by ASEAN member country. After each country listing there is a brief note as well on the focus of the publications per country as a way of summarizing.

A. Brunei

1. Anderson J.A.R. 1963. The Flora of the Peat Swamp Forests of Sarawak and Brunei, including a catalogue of all recorded species of flowering plants, ferns and fern allies. *Gardens' Bulletin Singapore* 20: 131-228.
   An ecological survey of phanerograms, gymnosperms and pteridophytes was performed. However, the focus of this flora was on tree and shrub species.
2. Ashton P.S. 2002. Taxonomic Notes on the Tree Flora of Brunei: 1. *Gardens' Bulletin Singapore* 54: 207-216.
   Taxonomic changes in several floras as well as novelties were presented in the paper. An elaborate discussion was also provided.
3. Poulsen A.D. 1996. The herbaceous ground flora of the Batu Apoi Forest Reserve, Brunei Darussalam. *Tropical Rainforest Research-Current Issues*. pp. 43-57.
   Herbaceous ground flora in a Forest Reserve was surveyed and identified. The type of landscape and landslides was hypothesized to be the cause of high species richness in the sampling sites.
4. Poulsen A.D. and Pendry C.A. 1995. Inventories of ground herbs at three altitudes on Bukit Belalong, Brunei, Borneo. *Biodiversity & Conservation* 4(7): 745-757.
   A survey on the species richness, cover and density was done on three different altitudes of a rainforest. A difference on the herb communities was observed.
5. Williams C.N. 1980. Fertilizer Response of Napier Grass under Different Soil Conditions in Brunei. *Experimental Agriculture* 16(4): 415-423.
   The growth of Napier grass and optimum fertilizer levels varied with different soil types. In sandy clay loam, the highest dry forage yield was attained.

Few weed literature were gathered from Brunei and majority were focused on the flora of mountain and forests. Weed species present varied with respect to the changes in altitude and type of habitat. Also, the effect of agricultural management practice on weeds was reported.

B. Cambodia

1. Jahn G.C., Pheng, S., Khiev, B. and Chanty, P. 2000. Ecological Characterization of Biotic Constraints to Rice in Cambodia. *International Rice Research Notes* 25(3).
   At the four stages of crop development, pest evaluation was done. An analysis on the injury level, past cropping practices and effect on yield was also included in the study.
2. Jahn G.C., Pheng, S., Khiev, B. and Pol, C. 2001. Response of two rice cultivars to competition from *Echinochloa crus-galli*. *International Rice Research Notes* 26(2).
   Use of water and handweeding in Cambodia was considered not suitable due to scarcity in water and labor. Thus, use of competitive cultivars was studied.
3. Kamoshita A., Araki, Y. and Nguyen, Y.T.B. 2014. Weed biodiversity and rice production during the irrigation rehabilitation process in Cambodia. *Agriculture, Ecosystems and Environment* 194: 1-6.
   The effect of water depth, fertilization and weeding practices on weed diversity and rice production was evaluated. Certain weed species were favored in the different factors considered.
4. Kamoshita A., Ikeda, H., Yamagishi, J. and Ouk, M. 2010. Ecophysiological study on weed seed banks and weeds in Cambodian paddy fields with contrasting water availability. *Weed Biology and Management* 10(4): 261-272.
   The effect of water regimes on weed dynamics was determined. It was observed that water shortage in paddy fields will lead to weed emergence and abundance.
5. Kamoshita A., Ikeda, H., Yamagishi, J., Lor, B. and Ouk, M. 2016. Residual effects of cultivation methods on weed seed banks and weeds in Cambodia. *Weed Biology and Management* 16: 93-107.
   Effects of water depth, cultivation practices, herbicides and rice cultivar on weed were determined in this study. Weed species were either favored or suppressed by these factors.
6. Malik U. and Barik, A. 2014. Free fatty acids from the weed, *Polygonum orientale* leaves for attraction of the potential biocontrol agent, *Galerucella placida* (Coleoptera: Chrysomelidae). *Biocontrol Science and Technology* 25(5): 593-607.
   A confirmatory experiment on the presence, identity and amount of the free fatty acids responsible for attraction was done from the leaves of P. orientale.
7. Maxwell J.F. 2009. Vegetation and vascular flora of the Mekong River, Kratie and Steung Treng Provinces, Cambodia. *Maejo International Journal of Science and Technology* 3(1): 143-211.
   A detailed description and photographs of plants surveyed on selected rivers and terrestrial areas in Cambodia. Degree of degradation was highest in terrestrial areas due to human exploitation.
8. Pheng S., Olofsdotter, M., Jahn, G., Nesbit, H. and Adkins, S.W. 2009. Allelopathic potential of Cambodian rice lines under field conditions. *Weed Biology and Management* 9(4): 267-275.
   Allelopathic potential of several Cambodian rice lines was tested against three major weeds of rice. It was observed that weed establishment, height and dry weight were negatively affected.
9. Renner S.C., Vanna, N. and Eames, J.C. 2011. Observations on the spread and extent of alien invasive plant species in six protected areas in Cambodia**.** pp. 40-48.
   Seven alien plant species were surveyed on the borders of several protected areas in Cambodia. This study provides insight on the threat of these plants to biodiversity.

In Cambodia, most of the weed research was focused on interspecific interaction and response of weeds to management practices such as irrigation and cultivation methods. Also, an important study on the flora of selected river and terrestrial areas of Cambodia was published.

C. Indonesia

1. Anwar E.K. 1999. Weed growth condition on tidal swamp areas in South Sumatra (Indonesia). Seminar Nasional Peningkatan Produksi Padi Nasional Melalui Sistem Tabela Padi Sawah dan Pemanfaatan Lahan Kurang Produktif, Bandar Lampung (Indonesia). *Peragi.* (no page available).
   Swamp areas were considered as alternative cropping area in Java due to increasing non-agricultural use of arable lands. Determination of weed species present in the tidal swamp areas will aid in the development of appropriate and suitable weed management practices.
2. Basuki, A.S. Soedarsan and Ruswandi. 1980. Weed shifting in cacao plantation due to herbicide. *Menara Perkebunan* (Indonesia) 48(5): 133-138.
   Weed problems are prevalent in plantations of young cacao. Chemical and mechanical weed management practices were evaluated in this study.
3. Biswas M., Parveen, S., Shimozawa, H. and Nobukazu, N. 2005. Effects of *Azolla* species on weed emergence in a rice paddy ecosystem. *Weed Biology and Management* 5(4): 176-183.
   Effectiveness of Azolla with two types of fertilizer to control weeds in a lowland farm was assessed. Better coverage was observed in cow manure treatments with more weed species controlled and reduced weed biomass.
4. Cicuzza D., Clough, Y., Tjitrosoedirdjo, S.S. and Kessler, M. 2012. Responses of terrestrial herb assemblages to weeding and fertilization in cacao agroforests in Indonesia. *Agroforestry Systems* 85(1): 75-83.
   The effect of agricultural management practices on the terrestrial herbs was observed in three years. Changes in the species diversity, biomass and richness were evaluated.
5. Fritiana M., Parto, Y., Munandar and Budianta, D. 2013. Maize productivity and weed species shifts due to organic matter treatments and npk fertilizer applications in Sumatera Uplands, Indonesia. *Asian Pacific Weed Science Society and Weed Science Society of Indonesia* pp. 221-226.
   Dominant aquatic weeds surveyed in deep water and transplanted rice were evaluated. Several herbicides were tested for efficacy in controlling these weeds.
6. Haden V.R., Duxbury, J.M., Ditommaso, A., and Losey, J.E. 2008. Weed Community Dynamics in the System of Rice Intensification (SRI) and the Efficacy of Mechanical Cultivation and Competitive Rice Cultivars for Weed Control in Indonesia. *Journal of Sustainable Agriculture* 30(4): 5-26.
   Several weed control strategies under system of rice intensification (SRI) was tested. It was observed that mechanical cultivation reduces weed density, species number and dry weight of weeds.
7. Hamzah A., Kusuma, Z., Utomo, W.H., and Guritno, B. 2012. Siam weed (*Chromolaena odorata* L.) for phytoremediation of artisanal gold mine tailings. *Journal of Tropical Agriculture* 50(1): 88-91.
   Possible use of Siam weed for phytoremediation in gold mines was determined. Farmyard manure amended tailings allowed growth of the weed on the polluted soil.
8. Januawati M., Sudiarso, S. and Fatimah, R.S. 1998. The effects of water treatments and weed *Borreria alata* densities on the growth and production of *Centella asiatica* (L.) Urban. *Jurnal Penelitian Tanaman Industri* 4(2): 35-40.
   Water and weed impact on C. asiatica was evaluated in the experiment. The crucial weed density and water level for growth and production was determined.
9. Kathiresan R.M. and Deivasigamani, S. 2013. Invasive spread of water hyacinth in Veeranum irrigation system and the impact of herbicidal control on aquatic environment. Proceedings of the 24th Asian-Pacific Weed Science Society Conference. *Asian Pacific Weed Science Society and Weed Science Society of Indonesia*. pp. 151-158.

Veeranum lake was heavily infested by water hyacinth which could also infest farms relying to the lake for irrigation water. This study was beneficial for determining the safest herbicide for the aquatic environment and for irrigation purposes.

10. Kriticos D.J. and Randall, R.P. 2001. A comparison of systems to analyse potential weed distributions. In: Groves RH, Panetta FD & Virtue JG, editors. Weed Risk Assessment. Melbourne: CSIRO Publishing. pp. 61-79.
Several systems were already created for assessment of weed potential. This paper provided an elaborate evaluation and comparison of these systems.
11. Kuntohartono T., Sasongko, D., and Chudjaemi, M.D. 1990. Weed survey in cane field of Cintamanis sugar factory (South Sumatra, Indonesia) in 1989/1990 crop year. *Madjalah Perusahan Gula* 26(1,2): 9-19.
Weed survey was performed to determine the weed species present, its appearance based on growth stage of cane and season, and effect of various management practices.
12. Mawardi D. 1996. Various plant spacing and levels of nitrogen affecting weed infestation at cabbage field. *Jurnal Agrotropika* 1(2): 14-17.
The optimum plant spacing and nitrogen level was determined to increase production and reduce weed growth in cabbage.
13. Moenandir J and Rai, C. 1999. The effect of soil depth on the weed seeds from the seed bank and its GR50 oxyfluorfen determination. *Agrivita* 21(1): 46-53.
The correlation of number of weed seeds to soil depth was determined in this study. Also, oxyfluorfen was tested against the three weed species observed in the soil collected.
14. Otsamo A, Adjers, G., Hadi, T.S., Kuusipalo, J., and Vuokko, R. 1997. Evaluation of reforestation potential of 83 tree species planted on *Imperata cylindrica* dominated grassland – A case study from South Kalimantan, Indonesia. *New Forests* 14(2): 127-143.
Eighty-three tree species were evaluated for its potential for reforestation. The survival and growth rate of each species was noted for several years of observation.
15. Otsamo A, Adjers, G., Hadi, T.S., Kuusipalo, J., Tuomelo, K., and Vuokko, R. 1995. Effect of site preparation and initial fertilization on the establishment and growth of four plantation tree species used in reforestation of *Imperata cylindrica* (L.) Beauv. dominated grasslands. *Forest Ecology and Management* 73(1-3): 271-277.
For the reforestation, two land preparation practices, herbicide treatment and fertilization was tested for effectiveness and suitability. Several tree species were also considered in the reforestation of the grassland.
16. Pane H., Noor, E.S., Susanti, Z., and Mortimer, M. 2002. Weed Characterization in Walik Jerami Rice in Rainfed Lowland Area. *Penelitian Pertanian Tanaman Pangan* 21(3): 6-14.
Weed structure and dynamics in minimum tillage transplanted rice was evaluated. It was observed that weed diversity and shift was not affected by this practice.
17. Pane H., Noor, E.S., Dizon, M., and Mortimer, A.M. 2000. Weed communities of *gogorancah* rice and reflections on management. Characterizing and Understanding Rained Environments. *International Rice Research Institute*. pp. 269-304.
Abiotic factors and farm management practices affect weed shift and weed communities present. In this paper, different management practices were evaluated for effect on weeds.
18. Pons T.L. 1982. Factors affecting weed seed germination and seedling growth in lowland rice in Indonesia. *Weed Research* 22(3): 155-161.
Germination of weeds in lowland rice was evaluated based on the response to water treatments. Weed seeds germination varied on the water level and burial depth.
19. Potter L.M. 1996. The dynamics of *Imperata*: historical overview and current farmer perspectives, with special reference to South Kalimantan, Indonesia. *Agroforestry Systems* 36(1): 31-51.
A case study was done to assess the current status of Imperata in South Kalimantan, Indonesia based on changes in land use, vegetation and even human factor.

20. Ramadhanil R., Tjitrosoedirdjo, S.S. and Setiadi, D. 2008. Structure and composition of understory plant assemblages of six land use types in the Lore Lindu National Park, Central Sulawesi, Indonesia. *Bangladesh Journal of Plant Taxonomy* 15(1): 1-12.
Forest and Cacao plantations were compared based on the number of understory plant species. It was observed that more species were present in disturbed areas.
21. Saputro S.E. and Ismail, I. 1992. Performance of some weed species at the ratoon cane on unirrigated land of Bungamayang Sugar Factory and its effect to cane and sugar yield. *Madjalah Perusahaan Gula* 28 (1,2): 12-18.
It was observed that Mikania cordata was the most dominant weed species. Weeds reduced the number of stalks and sugar yield.
22. Setyowati-Indarto N. 2000. Weed diversity on growth of sweet potato (*Ipomoea batatas* Lamk.) at and after planting. *Jurnal Penelitian Pertanian* 4(8): 25-31.
Weed diversity during and after planting was considered. It was observed that more families but less representative species were present at planting compared to after planting.
23. Sumardi S. 2000. Injuries on Seedlings Caused by Potential Weed in Tropical Rain Forest Regeneration Areas. *Jurnal Perlindungan Tanaman Indonesia* 6(1). (no page available)
Weed dominance and damage on seedlings were affected by canopy opening, planting system and part of the seedling.
24. Sunarno B. and Halle, F. 1986. Spatial distribution of dicotyledonous weed architectures in a shrub vegetation of Menggala, Central Java (Indonesia). *Berita Biologi* 3(6): 253:260.
The correlation of weed distribution with succession was determined in the study. Results showed that higher weed stratum level have less members and number of models.
25. Tasrif A., Juraimi, A.S., Kadir, J., Sastroutomo, and Napis, S. 2004. Genetic Diversity of *Echinohloa Crus-galli* Var. Crus-galli (L.) Beauv (Barnyardgrass: Poaceae) Ecotypes in Malaysia and Indonesia as Revealed by Rapd Markers. *Asian Journal of Plant Sciences* 3(2): 231-238.
Four Malaysian and Indonesian barnyard grass ecotypes were evaluated. The genetic diversity and variability of the ecotypes was studied.
26. Tjitrosoedirdjo S.S. 2005. Inventory of the Invasive Plant Species in Indonesia. *BIOTROPIA-The Southeast Asian Journal of Tropical Biology* 5.
Alien plant species in Indonesia was collected and identified using prior studies. Weed description and distribution were included.
27. Turvey N.D. 1995. Afforestation of *lmperata* grasslands in Indonesia: results of industrial tree plantation research trials at Teluk Sirih on Pulau Laut, Kalimantan Selatan. *ACIAR Technical Reports* 33. p.43.
Several practices were evaluated to determine its suitability for the establishment of Eucalyptus and Acacia trees. The most suitable tree species were also determined in the study.
28. Wahyuni I. and Tjitrosoedirdjo, S.S. 2013. Observation on the development of important weeds and invasive alien plant species in Indonesia. Proceedings of the 24th Asian-Pacific Weed Science Society Conference. *Asian Pacific Weed Science Society and Weed Science Society of Indonesia.* pp. 159-165.
Several invasive alien weeds in Indonesia was enumerated and discussed in this paper. This was raised due to the impact of these weeds to natural biodiversity of an area.
29. Whittaker R.J., Bush, M.B., and Richards, K. 1989. Plant Recolonization and Vegetation Succession on the Krakatau Islands, Indonesia. *Ecological Monographs* 59(2): 59-123.
Effects of several natural and human activities on the vegetation and flora were evaluated. The species diversity and types of species present was also determined.

30. Wilson C. and Mudita, W. 2000. Fire and Weeds: Interactions and Management Implications. Fire and sustainable agricultural and forestry development in Eastern Indonesia and Northern Australia. *Australian Centre for International Agricultural Research Canberra*. pp. 65-68.
Shifts to fire-resistant weeds in areas of Australia and Indonesia were due to frequent burning activities. The positive impact of fire to these weeds lead to its dominance in the area.
31. Wiroatmodjo J., Utomo, I.H., Sulistyono, E., Yani, A. and Martopo, D. 1990. Effects of irrigation levels, fertilization and densities of Borreria alata weed to the growth and dry weight of patchouly crop (*Pogostemon cablin* Benth). *Buletin agronomi* 19(2): 25-31.
Two experiments were done to evaluate the effect of irrigation levels, fertilization and densities of B. alata on the crop. The competitiveness of B. alata was also determined in the experiment.
32. Yamashita N., Ohta, S., and Hardjono, A. 2008. Soil changes induced by *Acacia mangium* plantation establishment: Comparison with secondary forest and *Imperata cylindrica* grassland soils in South Sumatra, Indonesia. *Forest Ecology and Management* 254(2): 362-370.
Soil pH level was obtained and compared in Acacia forests and Imperata grasslands. Differences in the exchangeable cations were deemed responsible for the soil acidity.
33. Zoschke A. 1990. Yield Losses in Tropical Rice as Influenced by the Composition of Weed Flora and the Timing of its Elimination. *Pest Management in Rice*. pp. 300-313.
Yield losses varied with season and type of rice production. Early elimination of weeds was observed to be beneficial for increasing rice yield.
34. Zuamah R., Zuamah, H., Yang, G.M., and Choi, J.S. 2014. Growth of Zoysiagrass and Seashore Paspalum on Volcano Eruption Sand and Clayey Soil with Organic and Inorganic Fertilizers in Indonesia. *Weed & Turfgrass Science* 3(3): 240-245.
The potential of volcano ash as growing medium for turfgrass was evaluated in this study. Two weeds and type of fertilizers were also tested.

Half of the gathered publications in Indonesia were devoted to research on the response of weeds to several management practices such as fertilization, irrigation, cultivation and herbicide application. There were also a number of ecological studies focusing on single and communities of weeds in different locations. However, only three taxonomic papers on weeds were documented and annotated.

D. Laos

1. Inamura T., Miyagawa, S., Singvilay, O., Sipaseauth, N., and Kono, Y. 2003. Competition between weeds and wet season transplanted paddy rice for nitrogen use, growth and yield in the central and northern regions of Laos. *Weed Biology and Management* 3(4): 213-221.
Rice-weed competition was evaluated based on the nitrogen use. It was observed that the rice aboveground biomass, yield (panicles and seeds) was affected by competition but harvest index and nitrogen use efficiency remained the same.
2. Kosaka Y., Takeda, S., Sithirajvongsa, S., and Xaydala, K. 2006. Plant Diversity in Paddy Fields in Relation to Agricultural Practices in Savannakhet Province, Laos. *Economic Botany* 60(1): 49-61.
Plants were surveyed and classified in the paddy fields. Three factors were considered in the study of high species diversity: presence of unique species and of remnant species and agricultural practices.
3. Roder W., Phengchanh, S., and Keoboulapha, B. 1995. Relationships between soil, fallow period, weeds and rice yield in slash-and-burn systems of Laos. *Plant and Soil* 176(1): 27-36.
Soil fertility was affected by different production practices including slash-and-burn and short fallow periods. Even with decreasing soil fertility, weed densities remained high and rice yield was low.

4. Roder W., Phengchanh, S., and Maniphone, S. 1997. Dynamics of soil and vegetation during crop and fallow period in slash-and-burn fields of northern Laos. *Geoderma* 76(1,2): 131-144.
   In this study, the effect of slash-and-burn practice in soil quality and fallow vegetation was measured. Mineralization and leaching were observed to be some of the causes of nutrient depletion in the area.
5. Roder W., Phengchanh, S., Keoboulapha, B., and Maniphone, S. 1995. *Chromolaena odorata* in slash-and-burn rice systems of Northern Laos. *Agrofrestry Systems* 31(1): 79-92.
   Chromolaena odorata was introduced to Laos and ever since it was easily dispersed and establish in slash-and-burn fields. However, several advantages of this weed during the fallow period were discussed in this paper.
6. Roder W., Phengchanh, S., and Keoboulapha, B. 1997. Weeds in slash-and-burn rice fields in northern Laos. *Weed Research* 37(2): 111-119.
   The impact of weeds in labor efficiency, rice fields and fallow periods was discussed. Common weed species were also enumerated.
7. Rouw A.D., Casagrande, M., Phaynaxay, K., Soulileuth, B., and Saito, K. 2014. Soil seedbanks in slash-and-burn rice fields of northern Laos. *Weed Research* 54(1): 26-37.
   Shift to shorter fallow periods resulted to severe weed infestation. This was due to increasing deposits in the seed bank and favored emergence of several weed species by slash-and-burn practice.
8. Saito K., Linquist, B., Keobualapha, T., Shiraiwa, T., and Horie, T. 2009. *Broussonetia papyrifera* (paper mulberry): its growth, yield and potential as a fallow crop in slash-and-burn upland rice system of northern Laos. Agroforestry Systems 76(3): 525-532.
   The potential use of Broussonetia papyrifera as a fallow crop following rice cultivation was assessed in the study. Also, the impact of this fallow crop on rice yield in different management practices was evaluated.
9. Shelton H.M. and Humpreys, L.R. 1972. Pasture establishment in upland rice crops at Na Pheng, Central Laos. *Tropical Grasslands* 6(3): 223-228.
   The impact of three pasture plants on upland rice yield was evaluated in this study. Less competition was observed in stylo treatments as compared to the other weed species.
10. Thomas R. and Humphreys, L.R. 1970. Pasture Improvement at Na Pheng, Central Laos. *Tropical Grasslands* 4(3): 229-236.
    Several strategies to improve pasture establishment and growth in Central Laos were assessed.

Slash-and-burn was observed to be the dominant farming system used in Cambodia through the years. Problems on yield and weed infestation in previously burned areas led to numerous researches to address these. However, only few studies on this matter as well as on taxonomic weed literature was observed.

E. Malaysia

1. Alloub H., Juraimi, A.S., Rajan, A., Kadir, J., Saad, M.S., and Sastroutomo, S. 2005. Growth behavior of itchgrass (*Rottboellia cochinchinensis*) in Peninsular Malaysia. *Weed Biology and Management* 5(1): 8-13.
   Growth patterns of three itchgrass groups were evaluated in a glasshouse experiment. Results showed that were differences in some of the plant characteristics across the groups.
2. Aqilah A., Asyraf, M., and Azmi, M. 2012. Weed survey in different cultural practice in Seberang Perai and Muda Rice Fields in Northern Malaysia. *Proceedings of The Annual International Conference, Syiah Kuala University-Life Sciences & Engineering Chapter* 2(1). (no page available).

Four types of planting practices were evaluated to determine weed composition. This study shows the differences in weed dominance in each planting practice which could be use for devising new weed management strategy.

3. Azmi M. and Mortimer, M. 2002. Weed Species shifts in response to serial herbicide application in wet-seeded rice in Malaysia. Direct Seeding: Research Strategies and Opportunities. *International Rice Research Institute*. 357-367.
   As a result of continuous use of herbicides, single weed species dominated in each treatment. For each herbicide used, different weed species dominated due to the herbicide selectivity.
4. Azmi M., Baki, B.B., and Mashhor, M. 1992. Weed communities in rice granary areas in Peninsular Malaysia. In *Proceedings of the 1st International Weed Control Congress. Melbourne, Australia: Weed Science Society of Victoria* 2: 57-60.
   Weed communities differed in the eight granaries surveyed in this study. However, ubiquitous weed species were also observed.
5. Bakar B.B., Yong-Woong, K., and Yin, F.W.N. 1997. Quantitative Assessments and Spatial Pattern Analyses of Weed Seed Banks of Arable Peat in Selangor, Malaysia. *Korean Journal of Weed Science* 17(3): 269-280.
   Each weed species showed variations in the pattern of distribution in the soil profile. Differences were attributed to variations in weed reproduction, spatial distribution and farm practices.
6. Baki H.B. 2004. Invasive Weed Species in Malaysian Agro-Ecosystems: Species, Impacts and Management. *Malaysian Journal of Science* 23(1). (no page available).
   Invasive weeds present in Malaysia were enumerated as well as the factors affecting its survival and invasion, impact on the ecosystem, environment and possible management strategies for effective weed management.
7. Begum M., Juraimi, A.S., Amartalingum, R., Syed Omar, S.R., and Bin Man, A. 2009. Effect of *Fimbristylis miliacea* Competition with MR220 Rice in Relation to Different Nitrogen Levels and Weed Density. *International Journal of Agriculture and Biology* 11: 183-187.
   Generally, yield increased with lower weed density and increasing nitrogen fertilization. In this study, response of rice to varying weed densities and nitrogen levels was discussed.
8. Begum M., Juraimi, A.S., Azmi, M., Rajan, A., and Syed Omar, S.R. 2005. Weed diversity of rice fields in four districts of Muda rice granary area, North-West Peninsular Malaysia**.** *Malays. Appl. Biol.* 34(2): 31-41.
   Weedy rice was observed to be the most dominant weed species in the four districts surveyed. The study was also able to show the presence of weeds from one district to another.
9. Begum M., Juraimi, A.S., Azmi, M., Rajan, A., and Syed Omar, S.R. 2005. Weed Vegetation of Direct Seeded Ricefields in Muda Rice Granary Areas of Peninsular Malaysia. *Pakistan Journal of Biological Sciences* 8(4): 537-541.
   It was observed that, at the heading stage of direct-seeded rice, grasses dominated the weed species present in the field.
10. Begum M., Juraimi, A.S., Azmi, M., Rajan, A., Syed Omar, S.R., and Rajan, A. 2008. Soil Seedbank of the Muda Rice Granary in Northwest Peninsular Malaysia Invaded by the Weed *Fimbristylis miliacea* (L.) Vahl. *Plant Protection Quarterly* 23(4): 157-161.
    Five dominant weed species were observed in the soil seed bank of rice fields surveyed. Among all these species, Fimbristylis miliacea has the highest emergence and abundant weed seed population.
11. Chuah T.S., Noor-Zalila, M.R., Cha, T.S., and Ismail, B.S. 2005. Paraquat and glyphosate resistance in woody borreria (*Hedyotis verticillata*) growing at oil palm plantations in Terengganu, Malaysia**.** *Malays. Appl. Biol.* 34(2): 43-49.
    The study was able to confirm that woody borreria biotypes in the selected locations possessed multiple resistances to Paraquat and glyphosate.

12. Hakim M.A., Juraimi, A.S., Hanafi, M.M., Ismail, M.R., and Selamat, A. 2013. A comparison of weed communities of coastal rice fields in Peninsular Malaysia. *Journal of Environmental Biology* 34: 847-856.
Weed survey was conducted to determine the prevalent weeds in the rice area. It was observed that most of the weeds were annuals, grasses and sedges.
13. Hakim M.A., Juraimi, A.S., Hanafi, M.M., Selamat, A., Ismail, M.R., and Karim, S.M.R. 2011. Studies on seed germination and growth in weed species of rice field under salinity stress. *Journal of Environmental Biology* 32: 529-536.
Under salt stress, some of the weeds were negatively affected in germination and seedling growth. However, growth of other weed species was favored under this condition.
14. Hakim M.A., Juraimi, A.S., Ismail, M.R., Hanafi, M.M., and Selamat, A. 2013. A survey on weed diversity in coastal rice fields of Sebarang Perak in Peninsular Malaysia**.** *Journal of Animal and Plant Sciences* 23(2): 532-542.
The authors were able to observe that the rice fields were generally dominated by annual weed species. Several ecological parameters were used in the study.
15. Ismail B.S. and Mah, L.S. 1993. Effects of *Mikania micrantha* H.B.K. on germination and growth of weed species. *Plant and Soil* 157(1): 107-113.
Effect of Mikania micrantha's debris on three weed species was evaluated in this study. Different responses were obtained on the germination and growth of the weeds.
16. Ismail B.S. and Lay Suat, M. 1994. Evidence for Allelopathic Activity of *Mikania micrantha* H.B.K. on Three Weed Species. *Pertanika Journal of Science and Technology* 2(1): 73-83.
Extracts of Mikania micrantha negatively affected the growth of the three weeds. However, root extracts exhibited greater suppression in growth compared to the leaf extracts.
17. Ismail B.S. and Phaik-Hong, K. 2004. A study of weed populations and their buried seeds in the soil of MARDI research station and at farmers' rice fields in Sungai Burung, Tanjung Karang, Selangor, Malaysia. *Pertanika Journal of Tropical Agricultural Science* 27(2): 113-120.
The highest number of weed seeds was observed in the upper 5 cm of the soil profile. Weed seed and population was evaluated before and after harvesting rice.
18. Ismail B.S. and Siddique, A.B. 2012. Identification of allelochemicals from *Fimbristylis miliacea* and their allelopathic potential against weed species. *Allelopathy Journal* 30(2): 311-318.
Allelochemicals were isolated, identified and tested against four weed species. The germination of all the weeds was reduced.
19. Ismail B.S., Tasrif, A., Latiff, A., and Sastroutomo, S.S. 1995. Weed seed populations in rubber and oil palm plantations with legume cover crops. *Plant Protection Quarterly* 10(1): 20-23.
The study showed that 80% of the weed seeds collected were from 4 weed species. Also, the correlation of increasing maturity of rubber plants to weed seed population was considered.
20. Ismail S. and Nornasuha, Y. 2014. Allelopathic effects of *Chromolaena odorata* (L.) King and Robinson and *Mikania micrantha* H.B.K. on three selected weed species. *Australian Journal of Crop Science* 8(7): 1024-1028.
Allelopathic properties of the two weed species were explored. In the study, negative effect on growth of the three weed species was observed.
21. Itoh K., Azmi, M., and Ahmad, A. 1992. Paraquat resistance in *Solanum nigrum*, *Crassocephalum crepidioides*, *Amaranthus lividus* and *Conyza sumatrensis* in Malaysia. *Proceedings of the 1st International Weed Control Congress* 2. (no page available).
Confirmation of resistant biotypes of four weed species was done. The level of resistance as well as distribution of these weeds was discussed in the paper.

22. Jalaludin A., Ngim, J., Bakar, B.H.J., and Alias, Z. 2010. Preliminary findings of potentially resistant goosegrass (*Eleusine indica*) to glufosinate-ammonium in Malaysia. *Weed Biology and Management* 10(4): 256-260.
Several biotypes were observed to have resistance on glufosinate-ammonium. Information on degree of resistance as well as positive biotypes of goosegrass was discussed in the article.
23. Juraimi A.S., Saiful, A.H.M, Uddin, M.K., Anuar, A.R., and Azmi, M. 2011. Diversity of weed communities under different water regimes in bertam irrigated direct seeded rice field. *Australian Journal of Crop Science* 5(5): 595-604.
Weed composition was surveyed under different flooding treatments. The study showed the response of different weed species to flooding.
24. Kamal-Uddin M.D., Juraimi, A.S., Begum, M., Ismail, M.R., Abdul Rahim, R., and Othman, R. 2009. Floristic Composition of Weed Community in Turf Grass Area of West Peninsular Malaysia. *International Journal of Agriculture and Biology* 11(1): 13-20.
Among all grasses, only four were identified to be turf grasses in the surveyed fields. Most of the observed plants were grass, sedge and broadleaf weeds.
25. Ketaren B.K., Ahmad, S.H., Abdul Shukor, J., and Rosenani, A.B. 2012. Floristic Composition of Weed Community in Selected Organic Vegetable Fields in Malaysia. *Trans. Malaysian Soc. Plant Physiol.* 20: 173-176.
There was high yield reduction due to weeds even in organic farms. Thus, knowledge on weed composition is a must to determine the proper management practice.
26. Kiew and Vollesen, K. 1997. *Asystasia* (Acanthaceae) in Malaysia. *Kew Bulletin* 52(4): 965-971.
None of the three taxa of Asystasia was native. New information and key of the three taxa found in Malaysia was presented.
27. Lee J. and Ngim, J. 2000. A first report of glyphosate-resistant goosegrass (*Eleusine indica* (L) Gaertn) in Malaysia. *Pest and Management Science* 56(4): 336-339.
Goosegrass is a noxious weed in Malaysia and reported incidence of resistance was studied in this paper. Actual field and station trial was done to confirm the said resistance of goosegrass biotype.
28. Lee S.A. 1995. Weed watch: *Paspalum vaginatum in* golf courses [Selangor, Malaysia]. *The Planters*. (no page available)
The ecology and biology of Paspalum vaginatum was described in this article. Effect of several management practices on spread and reproduction was also included.
29. Lee S.A. 1997. Weed watch: the fern, *Drymoglossum piloselloides* (L.) Presl. in Malaysia. *The Planters*. (no page available).
Drymoglossum piloselloides can easily colonize trees true smothering, shading and strangulation. The author found out that these have direct and indirect effect on dieback of branches.
30. Mansor M. 1996. Noxious Floating Weeds of Malaysia. Management and Ecology of Freshwater Plants. *Springer Netherlands* 120: 121-125.
Four noxious weeds were observed from 10 years of weed survey in bodies of water in Malaysia. The prevalence of these was attributed to several environmental factors.
31. Mansor M., Karim, S.M.R., and Hamid, Z.A.A. 2012. Seasonal Variation in Weed Seedbank in the Rice Field Soils of Muda Area, Peninsular Malaysia**.** *World Applied Sciences Journal* 20(8): 1086-1091.
Differences in the weed seed bank population in two seasons were observed. Majority of the seeds were from the common weeds of rice.
32. Mohamed M.A.H., Baki, B., Bakar, B., and Wati, H.N. 1996. The genus Mimosa with special reference tom. Quadrivalvis l. Var. Leptocarpa (D.C.) earnedy, a new species record for the weed flora in Malaysia. *BIOTROPIA- The Southeast Asian Journal of Tropical Biology* 9. (no page available).

33. Ooi D.J., Iqbal, S., and Ismail, M. 2012. Proximate Composition, Nutritional Attributes and Mineral Composition of *Peperomia pellucida* L. (Ketumpangan Air) Grown in Malaysia. *Molecules* 17(9): 11139-11145.
Chemical characterization of P. pellucida in Malaysia was presented in this study. Possible uses of these were also discussed.
34. Rahman M.M., Sahid, I.B., and Juraimi, A.S. 2010. Study on Resistant Biotypes of *Echinochloa crus-galli* in Malaysia. *Australia Journal of Crop Science* 4(2): 107-115.
Three herbicides were tested against 10 E. crus-galli biotypes to identify resistant populations. One biotype was observed to have multiple resistances.
35. Rezaul Karim S.M. 2012. Review on Weed Research with Special Reference to Bangladesh and Malaysia**.** UMK Library. pp. 303-354.
The book was a compilation of weed related to weed biology, ecology and management on Malaysia and Bangladesh.
36. Sahid A.B. and Juraimi, A.S. 1990. Studies on the germination of *Asystasia intrusa* seeds [weed of rubber, oil palm and coffee; Malaysia]. *Plant Protection.* (no page available)
The effect of temperature, pH, light, soil depth and NaCl concentration on seed germination of Asystasia intrusa was studied.
37. Sahid I., Nor Faezah, Z., and Ho, N.K. 1995. Weed Populations and their buried seeds in rice fields of the Muda Area, Kedah, Malaysia. *Pertanika Journal of Tropical Agricultural Science* 18 (1): 21-28.
Buried weed seed population varied with cultural management practices. Based on the study, the highest number of buried weed seeds was found on the topsoil of dry-seeded rice farms.
38. Sahid I.B. and Sugau, J.B. 1993. Allelopathic Effect of Lantana (*Lantana camara*) and Siam Weed (*Chromolaena odorata*) on Selected Crops. *Weed Science* 41(2): 303-308.
Emergence and dry weight of five crop species was tested against the allelopathic properties of weed debris of Lantana and Siam. Studies were conducted on the laboratory, greenhouse and field.
39. Sahid I.B., Ibrahim, R.B., and Kadri, S. 1996. Effects of watering frequency, shade and glyphosate application on *Paspalum conjugatum* Berg (sour grass). *Crop Protection* 15(1): 15-19.
It was observed that there were differences in the response of sour grass to watering, shade glyphosate, and combination of treatments. Generally, shading aggravates the effect on the weed of either glyphosate or less watering.
40. Samedani B., Juraimi, A.S., Rafii, M.Y., Anuar, A.R., Sheikh Awadz, S.A., and Anwar, M.P. 2013. Allelopathic Effects of Litter *Axonopus compressus* against Two Weedy Species and Its Persistence in Soil. *The Scientific World Journal.* pp. 1-8.
Litter leachates of the studied weed received variable responses from the germination and seedling growth of two other weed species. The phenolic content of the leachates were also evaluated in the study.
41. Seng C.T. and Sahid, I.B. 2010. The Status of Weed Resistance in Plantation Crops of Malaysia. *The Planter*s 86(1014): 615-620.
Some weed species in several states of Malaysia were observed to be resistant in commonly used herbicides. Malaysia depends greatly on herbicide for weed control.
42. Seng C.T., Van Lun, L., San, C.T., and Sahid, I.B. 2010. Initial report of glufosinate and paraquat multiple resistance that evolved in a biotype of goosegrass (*Eleusine indica*) in Malaysia. *Weed Biology and Management* 10(4): 229-233.
Continuous and frequent use of glufosinate and paraquat led to the formation of multiple resistance in goosegrass.

43. Sulaiman G., Hussein, M.Y., and Idris, A.B. 2004. The Abundance and Parasitism on the Egg Masses of the Asiatic Corn Borer *Ostrinia furnacalis* Guenee in Weedy and Weed-Free Cornfields in Malaysia**.** *International Journal of Agriculture and Biology* 6(1): 36-38.
More egg masses of Asiatic corn borer was parasitized in weedy plots. The study shows the importance of weeds on the ecosystem.
44. Uddin M.K., Juraimi, A.S., Hossain, M.S., Unhar, M.A.U., Ali, M.E., and Rahman, M.M. 2014. Purslane Weed (*Portulaca oleracea*): A Prospective Plant Source of Nutrition, Omega-3 Fatty Acid, and Antioxidant Attributes. *The Scientific World Journal*. (no page available).
Weeds could also have medicinal and anti-oxidant properties. The review article focused on the economical/ medicinal properties of purslane.
45. Uddin M.K., Juraimi, A.S., Ismail, M.R., and Brosnan. 2010. Characterizing Weed Populations in Different Turfgrass Sites throughout the Klang Valley of Western Peninsular Malaysia. *Weed Technology* 24 (2): 173-181.
Weed frequency, distribution, uniformity, density and other ecological parameters were evaluated in several areas of Klang Valley. The observed parameters varied with the type of lawns (residential, golf course, fields).
46. Wee Y.C. 1974. Viable seeds and spores of weed species in peat soil under pineapple cultivation. *Weed Research* 14(3): 193-196.
Soil sample were obtained from peats that have been cultivated for different durations. Large number of spores and weed seeds were observed.

Malaysia's great dependence on herbicides before led to the development of many resistant weed species and ecotypes as stated in several articles listed above. Most of these researches focused on the degree of resistance. Other studies were based on the characterization of weed population in different farming system, management practices and locations. The differences and similarities in the weed flora in the various sites showed the ubiquitous nature or selectivity of weeds. There were also reports on allelopathic potential of weeds against other weeds which were deemed as potential weed management strategy.

F. Myanmar

1. Delmail D. 2010. Validation of *Muhlenbergia fasciculata* (Poaceae) endemic to Myanmar. *Nordic Journal of Botany* 28(3): 298.
Corrections and validation on the invalidly published Muhlenbergia fasciculata was discussed in this paper.
2. Dong S.K., Cui, B.S., Yang, Z.F., Liu, S.L., Ding, Z.K., Zhu, J.J., Yao, W.K., and Wei, G.L. 2008. The role of road disturbance in the dispersal and spread of *Ageratina adenophora* along the Dian–Myanmar International Road. *Weed Research* 48(3): 282-288.
Ageratina adenophora is an exotic weed that must be monitored to prevent spread and invasion in and outside of Myanmar.
3. New T.Y., Moon, M.O., Hwang, I.C., Lee, S.H., and Sun, B.Y. 2016. New records of ferns in the flora of Myanmar found in Natma Taung National Park in the Chin State. *Korean Journal of Plant Taxonomy* 46(3): 283-287.
Plant survey on Natma Tung National Park led to the discovery and identification of four fern species that were not included in the previous version of Flora of Myanmar.
4. Paszko B. 2014. *Deyeuxia himalaica* (Poaceae, Agrostidinae): taxonomy and its first record from Myanmar. *Phytotaxa* 156(5): 285-290.
A clarification on the taxonomy with reference to inadequate key for identification of Deyeuxia himalaica was discussed on this paper.

5. Tanaka N., Ohi-Toma, T., and Murata, J. 2010. A new species of *Argostemma* (*Rubiaceae*) from Mount Victoria, Myanmar. *Blumea - Biodiversity, Evolution and Biogeography of Plants* 55(1): 65-67.
   A newly discovered species of Rubiaceae was illustrated in this paper. A detailed taxonomic and biological description of this plant was also included.

There is a need to increase the research works of Myanmar in the field of weed ecology and management. Four out of five publications gathered were taxonomic studies.

G. Philippines

1. Alterrado E.D. 1996. Hitherto unreported weed species under coconut and in major crop lands in Bago Oshiro, Davao City and vicinities. *PMCP 27th Anniversary and Annual Scientific Meeting:Proceedings.* p. 109.
   An unreported weed species was observed in several plantations in Mindanao. It was identified to be a member of Asteraceae.
2. Alterrado E.D. 2004. Distribution of the noxious weed *Helianthus cucumerifolius* Torr. and gray in the Davao provinces. *Philippine Journal of Crop Science* 29(1): 34.
   Weed survey on the distribution of Helianthus cucumerifolius was performed on several areas of Davao. The effect of wet and dry periods on growth of this weed was also included in the paper.
3. Angelito F.I. 1984. Survey of the seed-borne fungi of common weed species in CLSU [Central Luzon State Univ., Munoz, Nueva Ecija, Philippines]. *CLSU Scientific Journal* 5(2), 6(1): 21.
   Ten weed species were examined for possible contamination. Different weed species were affected by different fungal pathogens.
4. Awan T.H., Sta Cruz, P.C., and Chauhan, B.S. 2015. Ecological significance of rice (*Oryza sativa*) planting density and nitrogen rates in managing the growth and competitive ability of itchgrass (*Rottboellia cochinchinensis*) in direct-seeded rice systems. *J Pest Sci* 88: 427-438.
   Rottboellia cochinchinensis response to fertilizer application was related to its shade-avoiding mechanism. This study gives an overview of weed competitiveness against rice.
5. Bañez S.E.S. and Ilupa, N.A. 2011. Phytochemical and Pesticidal Properties of Barsanga (*Cyperus rotundus* Linn.). *IAMURE Journal of Science and Clinical Laboratory* 1(1): 4.
   Extraction, identification and test of phytochemicals present in purple nutsedge were discussed. Many compounds of medicinal and pesticidal importance were also evaluated.
6. Bernasor P.C. and Datta, S.K. 1981. Long-term effects of reduced tillage on weed shift in wetland rice. *Annual Conference of the Pest Control Council of the Philippines*. p. 15.
   Change from conventional to zero tillage led to weed shift from annuals to perennials. This study showed the effect of continuous type of tillage on yield.
7. Bhandari D.C. and Moody, K. 1981. Ecology of the weed communities growing in association with a rainfed rice (*Oryza sativa* L.) cropping system. *Annual Conference of the Pest Control Council of the Philippines.* p.22.
   Weed communities differed with various management practices in rice farms. The weed population was also affected by type of rice production.
8. Chauhan B.S. and Abugho, S.B. 2013. Effects of water regime, nitrogen fertilization, and rice plant density on growth and reproduction of lowland weed *Echinochloa crus-galli.* Crop Protection 54: 142-147.
   Growth and reproduction of E. crus-galli was greatly affected by rice interference. Through competition, weed performance may be reduced.

9. Chauhan B.S. and Johnson, D.E. 2008. Germination Ecology of Goosegrass (*Eleusine indica*): An Important Grass Weed of Rainfed Rice. *Weed Science* 56(5): 699-706.
The germination response of goosegrass to varying levels of temperature, soil pH, burial depth and cultural management was evaluated in this study. Results could be used for devising weed management for prevention of emergence.
10. Chauhan B.S. 2012. Weed Ecology and Weed Management Strategies for Dry-Seeded Rice in Asia. *Weed technology* 26(1): 1-13.
Integrated weed management (IWM) practices must be done to properly manage weed population in DSR. Several ways on IWM was listed and evaluated on this paper.
11. Chauhan B.S. 2013. Effect of tillage systems, seeding rates, and herbicides on weed growth and grain yield in dry-seeded rice systems in the Philippines. *Crop Protection* 54: 244-250.
The effect of various management practices on weed and rice yield was evaluated. It was based on a dry-seeded rice (DSR) farming, a common practice in Asia.
12. Codilla L.T and Mandras, B.T. 2012. Biotype of the invasive plant species *Chromolaena odorata* (ASTERACEAE: EUPATORIAE) in the Zamboanga Peninsula, the Philippines. *Philippine Journal of Systematic Biology* 4: 28-33.
Chromolaena odorata found in the Philippines was compared to those found in other parts of the world. The correlation between the findings, and the species invasion and biocontrol were evaluated in this study.
13. Donayre D.K.M. and Endino-Tayson, C.A. 2015. Competitive Ability, Critical Period of Competition, and Density Level of *Hydrolea zeylanica* (L.) Vahl against Transplanted-Irrigated Lowland Rice. *IAMURE International Journal of Ecology and Conservation* 14(1): 191-214.
The importance of competition and weed population on formation of proper weed management practices was the rationale of the study. In-depth descriptions on these factors were discussed.
14. Donayre D.K.M., Endino, C.U., Seville, C.U., and Ciocon, I.M.G. 2014. Major weeds and farmers' weed management practices in rainfed ricefields of Negros Island, Philippines. *Asia Life Sciences* 23(1): 149-174.
The weed species present and dominant in areas of Negros were evaluated together with the existing management practices in lowland rice fields.
15. Drost D.C. and Moody, K. 1981. Effect of weeding intensity on weed community composition in rice (Oryza sativa L.) and upland crops grown on a rainfed, bunded toposequence. *International Rice Research Institute*. p.11.
Weed flora varied depending on the management practices of rice and other crops farming system. The study gives an idea on possible shifts in weed flora with change in farm treatments.
16. Fortuna-Rosuman P. 2016. Alkaloids as Chemotaxonomic Marker of Four Selected Species of Eupatorium Weeds. *SPU Research journal on Global Education* 1. (no page available).
Four species of Eupatorium were identified and evaluated based on chemotaxonomy. Tests for alkaloids, fractionation and isolation were made.
17. Fuentes R.G., Altazar, A.M., Merca, F.E., Ismail, A.M., and Johnson, D.E. 2010. Morphological and physiological responses of lowland purple nutsedge (*Cyperus rotundus* L.) to flooding. *Annals of Botany*. p. 1-12.
Two ecotypes of C. rotundus were evaluated based on germination, morphological and physiological responses. This is a good study to identify the factors affecting weed survival and adaptation.
18. Galinato M.I. and Sajise, P.E. 1981. An ecological survey of the weed flora in the major root crop areas [sweet potato, cassava, yam and white potato] in the Philippines. *Annals of Tropical Research* 3(3): 214-222.
Wet season quantitative vegetation analysis was used to determine community types present in several root-crop farms. The study considered the effect of physico-chemical factors on the weed flora.

19. Gruezo W.S.M. and Denford, K.E. 1994. Taxonomy of *Arnica* L. subgenus Chamissonis Maguire (Asteraceae). *Asia Life Sciences* 3(2): 89-212.
A systematic revision on the seven taxa included in the subgenus Chamissonis Maguire was proposed. These plants were colonizers of disturbed habitats.
20. Hoque M.M. and Olvida, J.L. 1984. Relationship between weed population and rat damage to corn [*Zea mays*]. *Anniversary and Annual Convention Pest Control Council of the Philippines*. p.1.
Higher incidence of rat activity and damage was observed in weedy plots of corn as compared to the clean plots.
21. Janiya J.D. and Moody, K. 1984. Effect of water regimes on weed competition in upland rice (Oryza sativa). *Anniversary and Annual Convention Pest Control Council of the Philippines*. p.1.
Weeds affect nitrogen uptake of rice but reduces water loss in the field. This study showed the importance of weeds on water conservation.
22. Janiya J.D. and Moody, K. 1986. Weed populations in transplanted and wet-seeded rice (*Oryza sativa*) as affected by weed control method. *Anniversary and Annual Convention of the Pest Control Council of the Philippines*. p.1.
The response of weeds varied on the method of control used in the experiment. Handweeding was observed to be more sustainable compared to herbicide use.
23. Janiya J.D. and Moody, K. 1987. Weed emergence patterns in a tropical soil. *Journal of Plant Protection in the Tropics* 4(2): 107-114.
Emergence pattern varied on the six weed species studied. It was affected by soil moisture and other climatic factors.
24. Janiya J.D. and Moody, K. 1991. Weed and upland rice yield response to moisture and basal nitrogen. *Philippine Journal of Weed Science* 18: 41-56.
Weed growth and rice yield was favored primarily by availability of water. The study provides information on the different responses of weed and rice on the various levels of available water and fertilization.
25. Kim J.S. and Mercado, B.L. 1987. Magnitude and distribution of weed-seeds in lowland rice soil. *Philippine Agriculturist* 70(1-2): 55-59.
Viable seeds of several weed species were evaluated in lowland rice. Weed population and shift may be predicted with knowledge on soil seed bank.
26. Lopez F.S.S. and Tan, B.C. 1986. *Salvinia molesta* Mitchell is a weed to watch. *Philippine Journal of Crop Science* 11(1): 56.
Introduction and spread of Salvinia molesta was due to negligence and mistaken identity. A review and evaluation on the weed status in other countries and in the Philippines was presented in this paper.
27. Manuel J.S. 1984. Weed hosts of the plant parasitic nematodes. *Anniversary and Annual Convention of the Pest Control Council of the Philippines*. p.1.
Nine common root-nematodes were considered in the identification of host weed species. The documentation of host suitability was up to the species level.
28. Manuel J.S. 1987. *Salvinia molesta*: a new weed pest in the Philippines. *International Congress of Plant Protection, Manila (Philippines).* p.1.
A review on traits of S. molesta related to problems in paddy rice and rapid spread in the Philippines was indicated in this paper.
29. Martin E.C, Donayre, D.K.M., and Casimero, M.C. 2016. Incidence, Growth, and Agronomic Characteristics of Weedy Rice Variants from Iloilo Province, Philippines under Field and Screenhouse Conditions. *IAMURE International Journal of Ecology and Conservation* 19(1): 37-52.
Presence of weedy rice in rice farms of Iloilo was mainly due to seed contamination. In this study, the varieties of weedy rice observed in the field were evaluated and compared to cultivated rice.

30. Martin E.C, Donayre, D.K.M., and Casimero, M.C. 2014. Prevalence, Agronomic Characteristics and Biology of Weedy Rice Biotypes of Nueva Ecija, Philippines. *IAMURE International Journal of Ecology and Conservation* 12(1): 8.
Five weedy rice biotypes were surveyed on fields of Nueva Ecija. Advantageous traits of these biotypes were discussed in this paper.
31. Martin E.C, D.K.M. Donayre, M.C. Casimero, L.M. Juliano and J.C. Beltran. 2015. Prevalence of Lowland Ecotype *Cyperus rotundus* L. and Weed Management of Rice Farmers in Aliaga, Nueva Ecija, Philippines. *IAMURE International Journal of Ecology and Conservation* 13(1): 4.
Field and farmers were surveys were done to evaluate the dominance of purple nutsedge in selected areas of Nueva Ecija. The common weed management practices were also determined.
32. Mercado B.L. 1976. Some properties of the inhibitor from Rottboellia exaltata L. F. seed [grass weed on mungbean, soybean and cucumber in the Philippines]. *Philippine Weed Science Bulletin* 3: 40-45.
An evaluation of the chemical inhibitors present in R. cochinchinensis against several crops was presented in this study.
33. Mercado B.L. 1985. The development of resistance/tolerance to herbicides in weed population. *Inaugural SEARCA Professorial Chair Lecture*. p.34.
Development of resistance/tolerance to herbicides may be attributed to physiological change and/or change in metabolites produced by the weed.
34. Migo T.R. and Datta, S.K. 1982. Effect of different rice cultivars, seedling ages and nitrogen application methods on weed population and grain yields in transplanted rice. *National Conference of the Pest Control Council of the Philippines*. p. 25.
The response of weeds to rice varieties, management practices as affected by plant height and days to maturity.
35. Migo T.R., Mercado, B.L., and De Data, S.K. 1986. Response of *Sphenoclea zeylanica* to 2,4-D and other recommended herbicides for weed control in lowland rice (*Oryza sativa*). *Anniversary and Annual Convention of the Pest Control Council of the Philippines*. p.1.
The effect of 2,4-D on S. zeylanica varied depending on the growth stage, location and time of application. Through this study, tolerance and resistance of weeds may be evaluated.
36. Morita H., Martin, E.C., and Kabaki, N. 2012. Re-growth from the stem segments buried into puddled soil in *Hydrolea zeylanica* Vahl., a troublesome weed in the Philippines. *Pak. J. Weed Sci. Res*. 18: 435-439.
Hydrolea zeylanica is a troublesome perennial weed in Luzon. The study focuses on growth of this weed from stem segments under flooded and drained conditions.
37. Opeña J.L., Chauhan, B.S., and Baltazar, A.M. 2014. Seed Germination Ecology of *Echinochloa glabrescens* and Its Implication for Management in Rice (*Oryza sativa* L.). *PLoS ONE* 9(3): 1-13.
The effect of temperature, light, salt and osmotic stress, crop residue, time and depth of flooding, and herbicide application on emergence, survival and growth of E. glabrescens was discussed well in this paper.
38. Pablico P.P. and Moody, K. 1986. A dry season lowland rice (*Oryza sativa*) weed survey in Central and Southern Luzon, Philippines. *Philippine Weed Science Bulletin Special Issue*. 13: 39-49.
Sixty-one weed species that survived after control measures were identified. Some weeds were found to be present in only one province.
39. Pablico P.P. 1983. Weed populations and crop yield in rice-based cropping systems as influenced by tillage methods and weed control practices. (no page available).
Weed species that dominated first continued to dominate the area in the following years of cropping. The effect of different types of tillage on weeds was assessed on this paper.

40. Pancho J.V. 1986. Vegetative characters as aids to the identification of grass weed seedlings in the Philippines. *Anniversary and Annual Convention Pest Control Council of the Philippines*. p.1.
Identification of grass weed seedlings will be easier with the aid of the description, identification and illustration provided in this article.
41. Peña-Frontreras J.T., Villalobos, M.C., Baltazar, A.M., Merca, F.E., Ismail, A.M., and Johnson, D.E. 2009. Adaptation to flooding in upland and lowland ecotypes of *Cyperus rotundus*, a troublesome sedge weed of rice: tuber morphology and carbohydrate metabolism. *Annals of Botany* 103: 295-302.
The tolerance of Cyperus rotundus in lowland conditions was attributed to its morphology and metabolism.
42. Rao A.N. and Moody, K. 1986. Weed ecology in farmers' transplanted rice (Oryza sativa) fields. *Anniversary and Annual Convention of the Pest Control Council of the Philippines*. p.1.
Different farm management practices affect the weed growth, vegetative propagation and seed production. The paper discussed the management practices in the Philippines and its relationship with weed population and management.
43. Rao A.N. and Moody, K. 1987. Weed species occurring in rice seedling nurseries in Guimba, Nueva Ecija, Philippines. *International Rice Research Newsletter*. p.37.
More weed species were observed during the wet season compared to dry season. Resulting to higher competition between seedlings in the nursery and when transplanted.
44. Rasco, Jr., T.R., Oguis, G.K.R., Ragas, R.E.G., Masacupan, K.T., Camarillo, E.L.C., and Santos, S.M.B. 2012. Impacts of Long-term Weed Management on the Diversity and Abundance of Grasses in Banana Plantation Slopes in Davao City, Philippines. *BANWA* 9(1,2): 21-37.
The effect of chemical and manual weed management to the grass population and diversity was evaluated in this paper. Continuous management, regardless of type of management, resulted to reduced weed seeds in the soil seed bank.
45. Samiano A.R. and Motooka, P.S. 1979. The effect of nitrogen fertilization and frequency of irrigation on weed seed germination. *Philippine Weed Science Bulletin* 6: 50-54.
Differences in management practices impose different responses on the weed seed germination. The study provides information on these as well as on how to manipulate management practices to manage weeds.
46. Sonico R.L.T., Laguna, L.M., and Mandras, B.T. 1993. Weed survey in established coconut groves of Eastern Visayas. *Philippine Journal of Coconut Studies* 18(1): 7-10.
The weeds present in the plantation were assessed for the formulation of weed management strategies. Weed species surveyed varied and affected by location and time of sampling.
47. Talatal R.L. and Laguna, L.M. 1987. Weed flora in newly replanted coconut plantations of eastern Visayas. *Philippine Journal of Crop Science* 12(1): 28.
The weeds observed in different coconut plantations varied with Imperata cylindrica and Cyperus rotundus as the prevalent and potential noxious weed, respectively. It was observed that weed density was correlated with weed weights.
48. Timsina J., Robles, R.P., and Carangal, V.R. 1984. Previous crop influence on weed flora in dry-seeded rice (*Oryza sativa*). *Anniversary and Annual Convention of the Pest Control Council of the Philippines.* p.1.
Authors observed that weed population flourish and there was an increase in yield in fields with fallow period. However, the study was based only on legume-rice farming.
49. Trillana N., Chaudhary, R., Inamura, T., and Horie, T. 2001. Comparative growth performance of rice and the weed *Echinochloa oryzicola* in lowland and upland conditions. *International Rice Research Institute* 26(2): 70-72.
Echinochloa oryzicola was known to mimic and compete with rice. This study focuses on the performance of rice and E. oryzicola under upland and lowland conditions.

In the Philippines, majority of the weed researches were on the response of weeds to fertilization, irrigation, tillage and different weed management practices. Most of the studies were in rice fields considering that rice is a staple crop of the country. There were also numerous studies on the effect of location, vegetation and environmental conditions in the weed community present in an area. Despite numerous studies on weed ecology and management, only a small number of publications on weed taxonomy were done.

H. Singapore

1. Corlett R.T. 1988. The Naturalized Flora of Singapore. *Journal of Biogeography* 15(4): 657-663.
   The biology and origins of naturalized exotic species in Singapore was presented in the paper. The presence of these species was checked on undisturbed and disturbed areas.
2. Lok A.F.S.L., Tan, K.X., Ang, W.F., and Tan, H.T.W. 2010. The distribution and ecology of *Leucaena leucocephala* (Lam.) De Wit ssp. *leucocephala* (Fabaceae) in Singapore. Cosmos 6(1): 45-55.
   Considered as fourth most widespread tree weed species in Singapore, a study on Leucaena leucocephala was done. Possible use of this weed for reforestation and improvement of soil was considered.
3. Lok A.S.F.L., Chong, K.Y., Tan, K.X., and Tan, H.T.W. 2010. A checklist of the spontaneous exotic vascular plant flora of Singapore. *Cosmos* 6(1): 57-83.
   A compilation of naturalized exotic plant species as well as its distribution and potential to be an invasive species was presented.
4. Lok A.S.F.L., Tan, K.X., Chong, K.Y., Nghiem, T.P.L., and Tan, H.T.W. 2010. The distribution and ecology of *Cecropia* species (Urticaceae) in Singapore**.** *Nature in Singapore* 3: 199-209.
   A detailed botanical and taxonomic description of Cecropia was included in this paper. Ecological information and distribution of this species was also discussed.
5. Neo L., Yee, A.T.K., Chong, K.Y. and Tan, H.T.W. 2012. The Vascular Plant Flora of Abandoned Plantations in Singapore I: Clementi Forest. *Nature in Singapore* 5: 275-283.
   Vascular plants were identified in Clementi forest. Several native, exotic, cryptogenic, presumed extinct and threatened species were listed in this study.
6. Neo L., Yee, A.T.K., Chong, K.Y., Kee, C.Y., Lim, R.C.J., Ng, W.Q., Ng, X.Y., and Tan, H.T.W. 2013. The Vascular Plant Flora of Bukit Batok, Singapore. *Nature in Singapore* 7: 93-109.
   A secondary regrowth forest was surveyed for vascular plants. Native, exotic and endangered species were observed, listed and discussed in this paper.
7. Neo L., Yee, A.T.K., Chong, K.Y., Yeo, H.H.T., and Tan, H.T.W. 2013. The Vascular Plant Flora of Abandoned Plantations in Singapore II: Punggol End Forest. *Nature in Singapore* 6: 7-17.
   Native, exotic and cryptogenic species were observed in Punggol End forest. However, most of the species identified were exotic.
8. Neo L., Yee, A.T.K., Chong, K.Y., Yeo, Y.S., and Tan, H.T.W. 2014. The Vascular Plant Flora of Abandoned Plantations in Singapore IV: Windsor Forest. *Nature in Singapore* 7: 93-109.
   In Windsor forest, classified as secondary forest, many endangered and vulnerable vascular plants were identified. Thus, can be considered as refuge of these plant species.
9. Ridley H.N. 1900. The Flora of Singapore. *Journal of the Straits Branch of the Royal Asiatic Society* 33: 27-196.
   A detailed description of Singapore's geology and vegetation was presented. The plants found in the country was enumerated and elaborately described.

10. Ridley H.N. 1901. Supplementary Notes on the Flora of Singapore. *Journal of the Straits Branch of the Royal Asiatic Society* 35: 84-90.
    Additional information and corrections on the identification of the plant species listed in the Flora of Singapore were presented.
11. Tan H.T.W., Ibrahim, A.B., Chua, K.S., Turner, I.M., Wee, Y.C., and Chew, P.T. 1992. Additions to the Flora of Singapore, I. *Gardens' Bulletin Singapore* 44(2): 127-133.
    Twenty-four plant species were listed and added on the Flora of Singapore. A brief description of the plant characteristics and possible country of origin was also included in the list.
12. Teo S., Chong, K.Y., Kurukulasuriya, B.R., Chung, Y.F., and Tan, H.T.W. 2011. The status of an exotic shrub, *Acalypha siamensis* Oliv. ex Gage (Euphorbiaceae), in Singapore. *Nature in Singapore* 4: 227-231.
    A brief description of the biology and ecology of Acalypha siamensis was presented. Also, the present status of this plant in different localities and invasiveness was assessed.
13. Wee Y.C. 1989. Removal and leaching of nutrients by *Salvinia molesta* Mitchel and *Eichhornia crassipes* (Mart.) Solms. *BIOTROPIA* 2: 25-31.
    The study aims to prove that regular removal of weeds and pollutants in catchments will solve the problem with Eichhornia crassipes and Salvinia molesta in catchments.

Most of the publications gathered for Singapore were general and location-specific floras. Addition to the previous compilation of flora of Singapore was also reported. Other studies were based on biology, distribution and ecology of weed species. The potential of these weeds as invasive species were also considered. Many good publications on taxonomy and ecology were documented in Singapore but almost nil on weed management was listed.

I. Thailand

1. Andrews A.C. 1983. *Imperata cylindrica* in the Highlands of Northern Thailand: Its Productivity and Status as a Weed. *Mountain Research and Development* 3(4): 386-388.
   Low productivity in the highlands brought about by annual fires affect soil fertility. Assessment on the importance of Imperata cylindrica on the area and response to cattle feeding was made.
2. Chinawong S. and Suwanketnikom, R. 2001. Trends and expectations for research and technology in weed science in Thailand. *Weed Biology and Development* 1(1): 25-27.
   Most of the devised strategies were for agricultural improvement. Advances in weed research aims to support crop production to meet food demands.
3. Chomchalow N. 2011. Giant Salvinia- An Invasive Alien Aquatic Plant in Thailand. *AU Journal of Technology* 15(2): 77-82.
   This is a review article on the general characteristics, taxonomic description, control and related policies on Salvinia.
4. De Datta S.K. and Zahidul Hoque, M. 1981. Weeds, Weed Problems, and Weed Control in Deepwater Rice Areas. *Proceedings of the International Deepwater Rice Workshop*. pp. 430-431.
   The nature, distribution and seasonality of common noxious aquatic weeds of Thailand were described.
5. De Rouw A. 2001. Weed infestation and soil erosion resulting from the breakdown of the slash and burn cultivation system. *Soil erosion management research in Asian catchments: methodological approaches and initial results, Bangkok, IWMI.* pp. 85-93.
   This is a review article on slash and burn system including its advantages, problems and impact on the environment and land. The relation of this system to weed growth and population was also discussed.

6. Falvey J.L. and Hengmichai, P. 1979. Invasion of *Imperata cylindrica* (L.) Beauv. by *Eupatorium* Species in Northern Thailand. *Journal of Range Management* 32(5): 340-344.
The correlation between Eupatorium cover, years of grazing and distance from grazed area was considered in the study to determine the pattern of invasion by I. cylindrica.
7. Gouis G.D. and Gouis, B. 1990. Importance of weed infestation in rice in the functioning of agricultural production systems: Case study of a rainfed paddies area in Phatthalung Province, Southern Thailand. *7th Thailand National Farming Systems Seminar, Surat Thani (Thailand).* (no page available).
In the selected location, weed management was only practiced through land preparation. Weeds as forage for the cattle were not part of the control strategy.
8. Guangxi W., Wei, L., Xiaochun, W., and Ito, M. 2003. *Monochoria vaginalis* var. angustifolia, a new variety of the Pontederiaceae from Thailand. *Acta Phytotaxonomica Sinica* 41(6): 569-572.
A taxonomic description of the new Monochoria vaginalis variety was provided. The characteristics were compared to the variety vaginalis.
9. Harper R.S. 2009. Ground Flora and Its Control Under Rubber in South Thailand. *PANS Pest Articles & News Summaries* 19(1): 71-75.
Common weeds in rubber plantations were identified. Different methods of control were also included.
10. Ivens G.W. 1983. The natural control of *Imperata cylindrica* Nigeria and Northern Thailand. *Mountain Research and Development* 3(4): 372-377.
The two I. cylindrica varieties were described and compared. The role of its weaknesses in natural weed management was discussed.
11. Jongkaewwattana S. and Sangchyoswat, C. 1993. Weeds in soybean cropping system in Thailand: 2. Database management and expert system. (no page available).
An expert system of weed identification that consists of weed photographs, identities and descriptions were presented.
12. Junk W.J. 1977. Notes on aquatic weeds in some reservoir in Thailand. *Aquatic Botany* 3: 85-90.
Hydrophytes in four locations were identified and described. The importance of these weeds to bodies of water, human activities, installations and related policies was also considered.
13. Keer K.V., Thirathon, A., and Vejpas, C. 1996. Weed problems in a transitional upland rice based swidden system in Northern Thailand. *Highland Farming: Soil and The Future*. pp. 161-176.
Differences in weed composition and management was observed in upland rice and fallowing-burning type of farming. Assessment of the weed problem and effectiveness of current management practices was discussed.
14. Klaykaew A. 1996. Weeds within irrigation reservoirs in Northern Thailand. (no page available).
Weed survey was done in three major irrigation sources in Thailand. Identification, classification, description and photographs of the observed weeds were provided.
15. Kobayashi Y., Ito, M., Suwanarak, K., Noopradit, W., and Boonsrirat, C. 2003. Occurrence of *Pennisetum polystachion* ssp. *setosum* on the roadside verges and in some plantation crops of southern Thailand. *Weed Biology and Management* 3(1): 57-60.
Pennisetum was largely distributed and affected many parts Thailand after its introduction in 1952. In this study, this weed was observed to be prevalent in roadsides and rubber plantations.
16. Koen V.K., Chirawat, V., and Guy, T. 1995. Effects of fallow type and farmer's practices on weed infestation in an upland rice based swidden system in northern Thailand. *Weed Research*. (no page available).
The dominance of weed species varied according to the agronomic practices, clearing or burning. Some of the weeds were suppressed or promoted during fallow period.

17. Larsen K. 1994. Iresine (Amaranthaceae)-A genus new to Thailand. *Thai Forest Bulletin (Botany)* 22: 92-94.
Revisions on the Flora of Thailand were made after the discovery and identification of Iresine diffusa and herbstii.
18. Maneechote C., Samanwong, S., Zhang, X.Q., and Powles, S.B. 2005. Resistance to ACCase-inhibiting herbicides in sprangletop (*Leptochloa chinensis*). *Weed Science* 53(3): 290-295.
BLC1 biotype of sprangletop in Thailand was subjected to different experiments to test resistance against fenoxaprop-P.
19. Maxwell J.E. 1988. Re-identification of the weed *Mimosa invisa* Mart. ex Colla (Leguminosae, Mimosoideae) and a new record and new combination of the variant formerly known as *Mimosa invisa* var. inermis Adelb. in Thailand. *Songklanakarin Journal of Science and Technology* 10(2): 169-172.
An appropriate identity of Mimosa invisa found in Thailand was provided and discussed in this paper.
20. Meksawat S. and Pornprom, T. 2010. Allelopathic effect of itchgrass (*Rottboellia cochinchinensis*) on seed germination and plant growth. *Weed Biology and Management* 10(1): 16-24.
Determination of possible allelopathic properties of itch grass was a proposed solution for hazards of herbicide use. Several tests were performed to confirm the inhibitory effect of itch grass to other weeds.
21. Monkheang P., Sudmoon, R., Tanee, T., Noikotr, K., Bletter, N., and Chaveerach, A. 2011. Species diversity, usages, molecular markers and barcode of medicinal *Senna* species (Fabaceae, Caesalpinioideae) in Thailand. *Journal of Medicinal Plants Research* 5(26): 6173-6181.
Molecular markers were used to accurately and correctly identify Senna species in Thailand. Fourteen species were observed.
22. Morita H. and Kabaki, N. 2002. Effects of soil moisture conditions on the emergence of weeds and rice plants from rainfed paddy soils in north-east Thailand. *Weed Biology and Management* 2(4): 209-212.
The recommended level of soil moisture to suppress weed growth in directly sown rice was determined in the study.
23. Morita H. and Prakongvongs, C. 1995. Distribution and achne morphology of Mikania micrantha HBK in Thailand. *Weed Science Society of Japan* 34: 176-177.
Weed collection and evaluation was done to determine the characteristics of Mikania micrantha crucial for proper identification.
24. Musselman L.J. 1987. Major Weeds of Thailand. *Economic Botany* 41(2): 189.
Common weeds of Thailand were enumerated and described.
25. Noda K., Prakongvongs, C., and Teerawatsakul, M. 1983. Biological characteristics of tropical weed species in Thailand and their significance in weed control. *Conference of the Asian-Pacific Weed Science Society*. (no page available)
Weeds were classified and described based on type: grass, sedge, broadleaf. Other plant characteristics such as leaf anatomy and germination were discussed.
26. Noda K. 1985. Major Weeds in Thailand. *National Weed Science Research Institute Project.*
The article was a compilation of bibliographies of weeds in Thailand.
27. Nowak A., Nowak, S., and Nobis, M. 2015. First insights into weed communities of rice agrocoenoses in southern Thailand. *Phytocoenologia* 45(1,2): 157-174.
New phytosociological associations between weed species were observed. Diversity of weed composition was affected by intensity and type of cultivation.

28. Piepho H.P. and Alkämper, J. 1991. Effects of Integrated Rice-Cum-Fish Culture and Water Regime on Weed Growth and Development in Irrigated Lowland Rice Fields of Northeast Thailand. *Journal of Agronomy and Crop Science* 166(5): 289-299.
The article focuses on the response of weeds to low and high levels of water and type of fish present. The fertilizing and feeding effect of fish was assessed.
29. Piepho H.P. 1993. Weed species in irrigated ricefields in Northeast Thailand. *International Rice Research Newsletter* 18(1): 52.
The weed species observed in the selected location was identified. Weed ecological traits were also included in the paper.
30. Piepho H.P. 1993. Weed-fish interactions at different water levels in irrigated rice fields in Northeast Thailand. *International Rice Research Newsletter* 18(1): 54-55.
Weed population was reduced by high water level. The study aims to see the effect of fish on weed growth and population in varying water levels.
31. Prathepha P. 2009. Seed morphological traits and genotypic diversity of weedy rice (*Oryza sativa* f. *spontanea*) populations found in the Thai Hom Mali rice fields of north-eastern Thailand. *Weed Biology and Development* 9(1): 1-9.
The genetic variation of weedy rice in north-eastern Thailand was assessed based on seed morphology and amylose content. Possible introgression of cultivated rice and O. rufipogon was also discussed.
32. Prayoonrat P. 2005. Biodiversity of Medicinal Weeds in Chonburi Region, Thailand. *Acta Horticulturae* 675: 23-29.
Medicinal weeds identified in all possible areas of growth. The occurrence, medicinal properties and location of the weeds were categorized and evaluated in the study.
33. Radanachaless T., Maxwell, J.F., and Gypmantasiri, P. 1993. Weeds in soybean cropping system in Thailand: 1 Weeds distribution. (no page available).
Weed survey was done in major soybean producing provinces in Thailand. Weed distribution was evaluated and suggested to be used for databases and weed identification.
34. Reeder R.H., Ellison, C.A., and Thomas, M.B. 1996. Population dynamic aspects of the interaction between the weed *Rottboellia cochinchinensis* (itch grass) and the potential biological control agent *Sporisorium ophiuri* (head smut). (no page available).
Pot experiments and field trials were done to see the effectiveness of smut to potentially control itch grass. It was observed that smut-infected plants were negatively affected by competition.
35. Sakonnakhon S.P.N., Cadisch, G., Toomsan, B., Vityakon, P., Limpinuntana, V., Jogloy, S., and Patanothai, A. 2006. Weeds–friend or foe? The role of weed composition on stover nutrient recycling efficiency. *Field crops research* 97(2): 238-247.
The impact of weed composition on nutrient availability and recycling was emphasized. Fallow period where weeds and legume was grown showed different effects on crop growth of corn.
36. Sampanpanish P., Chaengcharoen, W., and Tongcumou, C. 2008. Heavy Metals Removal from Contaminated Soil by Siam Weed (*Chromolaena odorata*) and Vetiver grass (*Vetiveria zizanioides*). *Research Journal of Chemistry and Environment* 12(3): 23-33.
Siam weed was observed to have better heavy metal removal and accumulation than vetiver. Among the three plant parts tested, higher concentration of heavy metals was detected in the roots.
37. Sampanpanish P., Pongsapich, W., Khaodhiar, S., and Khan, E. 2006. Chromium Removal from Soil by Phytoremediation with Weed Plant Species in Thailand. *Water, Air, & Soil Pollution: Focus* 6(1): 191-206.
Six weed species were tested for chromium phytoremediation. The efficacy of the weeds was evaluated in this study based on the level of chromium accumulation on plant tissues.

38. Sethpakdee R. and Aphiwat, P. 1995. Growth responses of *Ruellia tuberosa* L. to different mowing heights. N*ational Research Report on Ornamental Plants, Bangkok (Thailand)*. pp. 44-52.
Ruellia tuberosa is a perennial weed in Thailand and a prolific seed producer. In this study, it was subjected to different mowing heights and light intensities to determine response in possible management practices.
39. Shibayama, Kittipong, P., Sangtong, T., Supatanakul, C., and Premasthira, C. 1982. Distribution and Habitats of *Mimosa pigra* L. in aquatic and other areas of Thailand. *Weed Science Society of Japan* 21: 157-158.
Mimosa pigra was distributed mainly in the north. Its habitat ranges from upland, marginal, and waterlogged areas.
40. Somprasong W., Prachasaisorade, V., Triboun, P., and Suraphanphichit, P. 2002. Collection and botanical studies of *Solanum* L. in northern Thailand. *Warasan Wichakan Kaset*. pp. 204-220.
Nine provinces of Thailand were surveyed for presence of Solanum weed species wherein fifteen species were identified. The uses and economic importance of these species were also discussed.
41. Suwanagul D. and Suwanaketnikom, R. 2002. Atrazine resistant weeds in Thailand. *Thai Journal of Agricultural Science*. pp. 75-81.
The two major weeds of corn in Central and North-Eastern parts of Thailand were subjected to test for atrazine resistance. Atrazine was already used in this country in the last 40 to 50 years.
42. Suwanarak K., Kongsangdao, S., and Ito, M. 1995. Effects of individual weed species on sugarcane. *National Cane and Sugar Conference, Bangkok (Thailand)*. pp. 82-106.
Allelopathic properties of weeds in sugarcane plantations were considered in this study. It was observed that the response of sugarcane varied (enhanced or inhibited) depending on the weed species.
43. Tanhan P., Kruatrachue, M., Pokethitiyook, P., and Chaiyarat, R. 2007. Uptake and accumulation of cadmium, lead and zinc by Siam weed [*Chromolaena odorata* (L.) King & Robinson]. *Chemosphere* 68(2): 323-329.
Siam weed was discovered to be a hyperaccumulator of lead and can possibly be used for phytoremediation. Differences in growth rates with increasing concentration of the tested heavy metals were also determined.
44. Tomita S., Nawata, E., Kono, Y., Nagata, Y., Noichana, C., Sributta, A., and Inamura, T. 2003. Differences in weed vegetation in response to cultivating methods and water conditions in rainfed paddy fields in north-east Thailand. *Weed Biology and Management* 3(2): 117-127.
Comparing direct and transplanted rice assessed the effect of cultural practices in the weed vegetation. Several locations with variations in environmental conditions and other abiotic factors were surveyed.
45. Zungsonthiporn S., Premasthira and Harada, J. 1987. Newly found aquatic weed, *Vossia cuspidata* (Roxb) Griff. in the lower central plains of Thailand." *Weed Science Society of Japan* 26: 23-24.
Lower plains are important for agriculture, irrigation and others. Identification of new weed species was crucial for prevention of spread across nearby farms and fisheries.
46. Zungsontiporn S. 2006. Global invasive plants in Thailand and its status and a case study of *Hydrocotyle umbellata* L." *Proceedings of International Workshop on Development of Database (APA5D) for Biological Invasion*. (no page available)
Invasive weed species in Thailand was evaluated, primarily the status of H. umbellata. It was introduced as an ornamental plant that was now present in many areas.

There was a balance in the number of ecological and taxonomic weed literature in Thailand. Taxonomic reports focused on the flora of several cropping systems. Other researches were based on the effect of several management practices such as irrigation, weed control, and cultivation methods on weed growth and population. Studies on heavy metal uptake by weeds were also observed and could be used for rehabilitation of contaminated soils in the future.

J. Vietnam

1. Chauhan B.S., Namuco, O.S., Ocampo, L.A.L., Son, T.T.N., Thu, T.T.A., Nam, N.N., Phuong, L.N., and Bajwa, A.A. 2015. Weedy rice (*Oryza sativa* f. *spontanea*) problems and management in wet direct-seeded rice (*O. sativa* L.) in the Mekong Delta of Vietnam. Crop Protection 78: 40-47.
   Problem of weedy rice in wet direct-seeded rice was a major production constraint in Mekong Delta, Vietnam. The effect of weedy rice and management practices in the yield of these areas were assessed.
2. Jeanplong J. 1973. Investigation of the weed flora of North Vietnam. *Botanikai Kozlemenyek* 60(3): 167-175.
   Plant species of flowering plants in North Vietnam was identified as indigenous, cultivated and weeds. The association of these weeds on crops and wastelands were described.
3. Khanh T.D., Cong, L.C., Chung, M., Xuan, T.D., and Tawata, S. 2009. Variation of weed-suppressing potential of Vietnamese rice cultivars against barnyardgrass (*Echinochloa crus-galli*) in laboratory, greenhouse and field screenings. *Journal of Plant Interactions* 4(3): 209-218.
   Rice cultivars of Vietnamese rice were tested for possible allelopathic properties against barnyard grass. Variations in the response of the weed to the rice cultivars were observed in the laboratory, greenhouse and field experiments.
4. Le B.T., Nguyen, T.L.T., and Adkins, S. 2012. Damage caused by *Merremia eberhardtii* and *Merremia boisiana* to biodiversity of Da Nang City, Vietnam. *Pakistan Journal of weed Science Research* 18: 895-905.
   The Merremia weed species in this study were invasive woody vine in forests of Vietnam. A study on control of this weed was done to address problems on biodiversity, tree growth suppression and forest fires.
5. Le T.B. and Truong, Q.B. 2016. Quick assessment of the invasiveness of non-native plant species by using eco-physiological parameters in Tram Chim National Park, Vietnam. *Weed Biology and Management* 16(4): 177-185.
   Weed survey was done in the National park to identify invasive, prominent and possible invasive weeds in the future.
6. Nguyen T.L.T., Nguyen, P.N., and Adkins, S. 2011. Parthenium weed (*Parthenium hysterophorus* L.) in Vietnam." *23rd Asian-Pacific Weed Science Society Conference. Volume 1: weed management in a changing world, Cairns, Queensland, Australia, 26-29 September 2011*. Asian-Pacific Weed Science Society. pp. 401- 402.
   Parthenium was a problematic seed in Vietnam due to its impact on health, biodiversity and management cost. To further understand this weed, its biological characteristics were evaluated.
7. Son N.H., Lam, P.V., Cam, N.V., Thanh, D.V.T., Dung, N.V., Khanh, L.D., and Forno, I.W. 2001. Preliminary studies on control of *Mimosa pigra* in Vietnam. *Strategic Weed Management in Vietnamese Wetlands; Weed control and Occupational Health and Safety Issues* (2001): 110-116.
   Mimosa pigra, an invasive species, is a threat in parks, farms, waterways and even roadsides. A review on its impact and methods of control were provided in this paper.

8. Son N.H. 2010. Study on biological, ecological characteristics of *Mimosa pigra* and negative impacts of its invasion in Vietnam. *Science and Technology Journal of Agriculture and Rural Development*. pp. 24-31.
   For the development of an effective weed management strategy for Mimosa pigra, the study provided vital information about the biology, physiology and ecology of the weed.
9. Tan D.T., Thu, P.Q., and Dell, B. 2012. Invasive Plant Species in the National Parks of Vietnam. *Forests* 3(4): 997-1016.
   Invasive weeds were identified and highly invasive ones were classified. Based on the data gathered, strategies on monitoring and managing weeds were also included in the paper.
10. Tan N.T., Son, N.H., Trung, H.M., Auld, B.A., and Hetherington, S.D. 2000. Weed flora of water rice in the Red River Delta, Vietnam. *International Journal of Pest Management* 46(4): 285-287.
    Weed species present in summer and spring rice-growing seasons were identified and compared to the weed flora of Australia and California.
11. Triet T. 2000. Alien invasive plants of the Mekong Delta: an overview. *Report of Workshop on Alien Invasive Species, Global Biodiversity Forum, South and Southeast Asia Session. Colombo, Sri Lanka, IUCN Regional Biodiversity Programme, Asia.*
    Non-cultivated weeds were identified and described in this paper. These were important because of these plants impact on biodiversity.
12. Wezel A. 2000. Weed vegetation and land use of upland maize fields in north-west Vietnam. *GeoJournal* 50(4): 349-357.
    Weed survey on the effect of change in cropping duration and land use intensity in weed infestation was done. The study also aims to develop weed management strategy involving soil conservation.
13. Xuan T.D., Shinkichi, T., Hong, N.H., Khanh, T.D., and Min, C. 2004. Assessment of phytotoxic action of *Ageratum conyzoides* L. (billy goat weed) on weeds. *Crop Protection* 23(10): 915-922.
    Billy goat weed were tested against major weeds of rice paddy. Chemical compounds responsible for these were identified in the different plant parts of this weed.

Few publications on weed research were obtained in Vietnam. However, the researches were fairly distributed to taxonomic and ecological studies as well as experiments on the effect of agricultural practices and interspecific interaction on weeds.

K. General Literature

1. Holm L.G., Plucknett, D.L., Pancho, J.V., and Herberger. J.P. 1977. The world's worst weeds. University Press. 609 pp.
   Several weed information such as description, habitat, propagation, biology, and local names were presented.
2. Holm L., Pancho, J.V., Herberger, J.P., and Pluncknett, D.L. 1979. A geographical atlas of world weeds. John Wiley and Sons. 391 pp.
   This book is a classic compilation of observed weeds worldwide and its relative importance. Illustrations and taxonomic descriptions of each weed species were included.
3. Daehler C.C. 1998. The taxonomic distribution of invasive angiosperm plants: Ecological insights and comparison to agricultural weeds. *Biological Conservation* 84(2): 167-180.
   The distribution and ecological differences of widespread and invasive weed species were discussed in this article. Differences were observed between the weed families present in agricultural and natural areas.

The general literature provided taxonomic descriptions on the weeds observed worldwide. Other information such as ecology, biology and importance were also included.

Many publications on weeds were noted but most of these were from Thailand, Malaysia, Indonesia and Philippines as shown in Table 1. These countries, including Vietnam, have the largest land area devoted to agricultural production in the region. Hence, most of the publications obtained were related to weed management. Weed management studies, which accounts for 30.9% of weed studies, focused on the response of weeds to irrigation, fertilization, herbicides, and other cultural practices. There is a need for more sustainable and effective management practices in the region to attain food security as stated in the ASEAN Food Security Reserves Agreement (Bello, 2005). There were also many reports on herbicide resistance of weeds. During the green revolution, high inputs of fertilizers and pesticides were used to improve crop yield. Nonetheless, environmental and health consequences were observed due to continuous and prolonged use (Pimentel, 1996). Great dependence on herbicides led to herbicide resistance of agricultural weed species. Ten studies on herbicide resistance of several weed species were annotated in this paper. Most of the observed resistances were on paraquat and glyphosate-treated *Eleusine indica* in Malaysia (Lee and Ngim, 2000; Jalaludin *et al*., 2010; Seng *et al.*, 2010). One biotype of *Echinochloa crus-galli* even showed multiple resistances against three herbicides (Rahman *et al*., 2010).

Table 1. Number of publications based on type of weed literature in ASEAN countries.

Country	Categories of Weed Literature			
	Taxonomic	**Ecological**	**Interspecific Interaction**	**Weed Management**
Brunei	4 (80.0%)	0	0	1 (20.0%)
Cambodia	1 (11.1%)	2 (22.2%)	3 (33.3%)	3 (33.3%)
Indonesia	3 (8.8%)	12 (35.3%)	2 (5.9%)	17 (50.0%)
Laos	2 (20.0%)	3 (30.0%)	1 (10.0%)	4 (40.0%)
Malaysia	9 (19.6%)	14(30.4%)	9 (19.6%)	14 (30.4%)
Myanmar	4 (80.0%)	1 (20.0%)	0	0
Philippines	7 (14.3%)	18 (36.7%)	3 (6.1%)	21 (42.9%)
Singapore	9 (69.2%)	4 (30.8%)	0	0
Thailand	13 (26.5%)	22 (44.9%)	5 (10.2%)	9 (18.4%)
Vietnam	4 (30.8%)	4 (30.8%)	2 (15.4%)	3 (23.1%)
TOTAL	56 (24.0%)	80 (34.3%)	25 (10.7%)	72 (30.9%)

Ecological weed publications topped the number of annotated publications in this study. The large number of research work on this field is important for a better assessment of weed problems in the ASEAN region as well as improve solutions on problems stated earlier such as herbicide resistances, and pest problems. Ecological and interspecific interaction studies are important for a holistic weed management program. Interspecific interaction studies constitute only 10.7% of weed research in the region with only 25 annotated publications. Some weeds were observed allelopathic against other weed species (Ismail and Siddique, 2012), or weeds against other crops (Sahid and Sugau, 1993). In Vietnam and Cambodia, rice cultivars were proven allelopathic against several rice-associated weeds (Khanh *et al.,* 2009; Pheng *et al.,* 2009). The allelopathic effect of weeds were assessed for potential use as herbicide, insect attractant or repellant. Through these studies, other important roles of weeds in management of pest populations may be emphasized and pave way for the creation of holistic management practices.

Weed taxonomic literature follows as the second classification with the most number of publications in the ASEAN region. The distribution varied on each country wherein Thailand and Cambodia have the highest and lowest taxonomic literature, respectively. Publications on weed taxonomy include re-identification of old species (Maxwell, 1988), introduction of new genus, species and variety of weeds (Larsen, 1994; Zungsonthiporn *et al.,* 1987; Guangxi *et al.,* 2003), and weed flora in plantations and aquatic areas (Musselman, 1987; Harper, 2009). This category of publications is necessary for correct identification of weeds, which is crucial for application of proper management and use of correct species for research or as medicine. Many problematic weeds such as *Salvinia molesta* (Lopez and Tan, 1986) aroused from mistaken identity and introduction. However, despite ranking second with the most number of annotated publications, a need for more taxonomic weed studies was perceived. Some of the countries have small number of taxonomic literature. These studies are necessary to prevent mistaken identity and introduction of invasive species in the future that may further aggravate problems on weeds in the region.

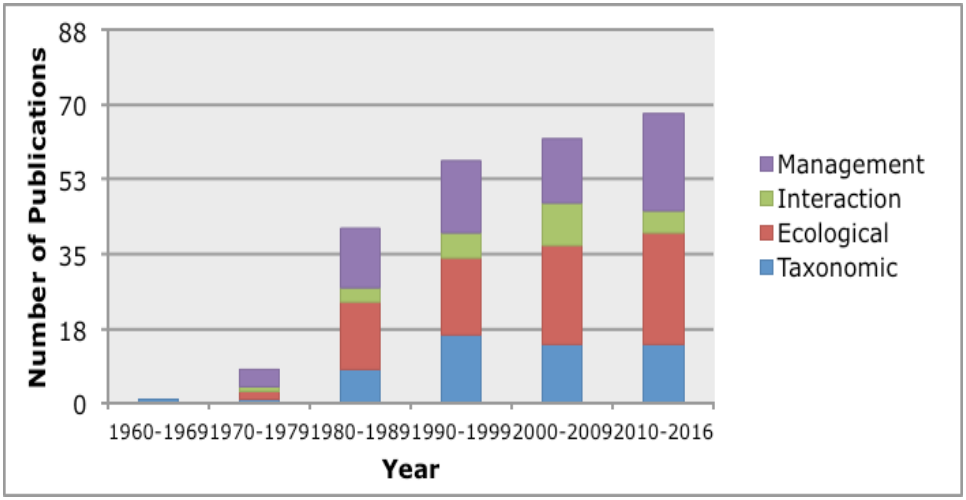

Figure 1. Trend of weed research from 1960 to 2016 in the ASEAN region.

Based on the number of weed literature obtained, an increasing number of weed publications in the ASEAN region were observed in the past 60 years as illustrated in Figure 1. There was a remarkable increase in the number of weed literature from 1970 to 1980. The impact of weeds on the environment and humans as well as on the agricultural sector led to the continuous researches on these fields. To meet the demands of the constantly growing population, researchers and scientists were discovering ways to manage weed population without compromising crop production. In the next ten years, it is necessary that there would be a constant increase in the number of publications with the trend of research towards ecological, taxonomic and holistic weed management studies.

CONCLUSION AND RECOMMENDATIONS

In this study, the trend of weed research in the ASEAN region was assessed. Results showed that there was an increase in the number of weed publications through the years. The tremendous increase in the research works started in the 1980s. The weed research in the region showed a bias towards weed management and ecological studies. This showed the interest of the region in increasing the yield and providing more environment friendly practices. The importance of weeds in agriculture is crucial for the development of ASEAN countries considering that agriculture plays a vital role in the economic growth. Also, a more holistic approach on weed problems is anticipated in the following years due to aim for sustainability. However, sustained monitoring and evaluation of the direction of weed research topics must be done to identify if the real weed problems in the region are addressed. This is necessary to provide more ideas to researchers for possible weed research topics that are timely and will have a great impact in the region.

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STATEMENT OF AUTHORSHIP

The first author and the second author collaboratively conceptualized the study. The first author drafted the paper under the guidance and supervision of the second author.

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