

Broadening the APWSS Horizon in the Asian-Pacific Region

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Abstract

The major challenge facing the Asian-Pacific Weed Scientists and land managers in the region is to develop the most effective and sustainable weed management approaches for all systems, including agriculture and natural land systems. Whatever weed management approach we develop must be sustainable, in both the short- and long-term and acceptable as safe for the community, wildlife, and the natural environment. Given my previous involvements with the APWSS, in this inaugural issue of the APWSS Journal, I wish to reflect upon how the Society may assist all member countries, particularly, those which are yet to be affiliated to the Society. We are challenged by the rapidly increasing human population in our region, food scarcity, some new weed problems, a changing climate and special issues, such as the development of herbicide resistance, as a result of overuse of herbicides and unsustainable farming practices. What options do we have to meet these challenges? I propose that APWSS must expand its involvement across the region, and to do so, requires a renewed effort to obtain funding from donors for more training, seminars, and conferences on weeds. As our founders expected, we must also develop a programme to assist various governments and agencies of different countries in identifying national needs on weed-related matters and solutions.

Keywords: Agriculture, Weed Science, Asian-Pacific region

Introduction

Today we are experiencing a rapid change in the development of science and its applications across all human endeavours. Scientific developments and progress during the past 40 years can be compared with those of the previous one hundred years, or possibly, even with the past five thousand years period. From now on, it is expected that another great scientific revolution is occurring in the coming ten to twenty-year period. Creative thinking and innovation are needed in all research areas that affect humanity. In this regard, how to utilize innovative technology in agriculture is fast

becoming an important issue. For instance, drone and robot technologies can be used in seeding, spraying chemicals and harvesting, etc. in agriculture, and farmers demand smart farming. In the Asian-Pacific countries, how could we adjust to a rapidly changing environment of scientific technology? How could we go together or share with the most underdeveloped countries in our region?

During the five decades (1967-2017), in our region, we have benefited from being associated with the Asian-Pacific Weed Science Society (APWSS) for developing various options for weed control in crop production and management of landscapes and waterways, etc. These aspects have often been

highlighted and discussed at successive APWSS Conferences and other international meetings. Many papers and books have been published disseminating this knowledge and sharing information with other Weed Scientists of our region, and beyond.

Detailed information on APWSS Conferences is available in the paper entitled 'Commemorating 50 years of the Asian-pacific Weed Science Society (1967-2017)' compiled by Aurora M. Baltazar (2017). A critical analysis of the APWSS Conferences, presentations, themes, and subjects is provided in Chapter 1 of the 50th Anniversary Celebratory Volume written by Nimal Chandrasena and A. N. Rao (2017). Additional information is also available in several reminiscences of the 50th Anniversary Celebratory Volume of APWSS 50th (APWSS, 2017).

In addition to the above, as APWSS passes more than five decades of its existence, I wish to reflect on some other activities, seminars, and conferences held in this region, which helped us to develop Weed Science in the region. These included several seminars, workshops and conferences supported by the Food & Agriculture Organization (FAO), International Rice Research Institute (IRRI), Food & Fertilizer Technology Centre in Taiwan and meetings of the Steering Committee for Weed Management for the Asia & the Pacific Region in 1990s, which was also established with support from the FAO. Particularly in case of Korea, the achievement of food self-sufficiency in 1977, through rice varietal improvement, made from crosses between *Oryza sativa* L. indica and japonica types of rice, accelerated the adoption of improved weed control technology, particularly, with the adoption of integrated practices that achieved highly effective weed control, combined with herbicides.

Widespread use of herbicides was common in the USA and Europe in the 1950s and 1960s. But herbicides were not commonly used in most South-Asian and South-East Asian countries, until much later. Also, the focus of Weed Science, at that time, was mostly on temperate weeds. There was not much attention paid to tropical weeds until the major weed book – '*The World's Worst Weeds*' was produced by LeRoy Holm et al. It is, perhaps, here, that the formation of the APWSS in 1967 (Chandrasena and Rao, 2017) had a significant impact. The Society's early years focused on promoting weed surveys in different countries and intensive studies of weeds, including weed biology, weed ecology, ecophysiology, and taxonomy, as a prelude to developing effective weed control solutions.

However, in the 1970s herbicides became an essential component for weed control in all crops in the region, including all cereals, vegetables, pulses fruit orchards and plantation crops, such as rubber, tea, and coconut. Economic developments of each of the countries of the region might be correlated with the choice of method(s) to control weeds in the field, and thereby, increased food production. It is evident that farmers select methods that provide the desired, high degree of weed control at the lowest cost, and therefore, the input prices are an essential factor determining input uses (De Datta et al., 1982).

Throughout the 1970s and 1980s, a range of herbicides and novel formulations (such as mixtures) were introduced at reasonably affordable prices for the major crops in the region. In my opinion, the APWSS biennial Conferences were a vital forum for the exchange of Weed Science information, including herbicides. These and other integrated practices, led to the adoption of effective weed control in cropping systems, resulting in significantly increased food production and poverty alleviation in the region. As Moody (1985) suggested, based on the likely impact in a highly populated region, the APWSS biennial Conference ranked among the most important Weed Science Conferences in the world.

National Weed Science Societies affiliated with APWSS

In 2017, Baltazar (2017) pointed out that 18 national Weed Science Societies in the Asian-Pacific region were closely affiliated with the APWSS (see Table 1 with some additional notes). Baltazar (2017) categorized any national or regional Weed Science Society, which actively participates in APWSS activities as an affiliate of APWSS.

On reflection, I am convinced that the Society has played a crucial role in connecting a vast number of Weed Scientists, from a large number of countries, over more than half-a-century period, by providing a vibrant forum for the exchange of Weed Science related information and ideas. In an address to the Society, Rahman et al. (2012) expressed the same view. However, Adkins (2017) emphasized that we are now entering a period of unprecedented population growth, one of rapid climate change, and the rapid emergence of several new and significant weeds. These weed problems and weed-related

issues need to be managed while balancing the growing demand for agricultural products and the need for biodiversity conservation and environmental protection in the years to come. What about the many unaffiliated countries to APWSS in Asian-Pacific region? Frankly, we do not know what is happening concerning Weed Science in those countries.

The presence of a number of unaffiliated countries to APWSS in Asian-Pacific region means that the Weed Science community is not well yet organized or have not been very active in these countries. The main question, then, I wish to ask is: How could we share the advancements of weed management technologies and help organize national Weed Science Society in unaffiliated countries to APWSS in Asian-Pacific region?

Table 1. National Weed Science Societies affiliated with APWSS (Source: Baltazar, 2017)

Name of Society	Country	Year Founded	Year Affiliated with APWSS
Weed Science Society of Indonesia	Indonesia	1971	1971
Weed Science Society of America	USA	1956	1973
New Zealand Plant Protection Society	New Zealand	1948	1973
Weed Science Society of Japan	Japan	1962	1973
Indian Society of Weed Science	India	1968	1973
Council of Australian Weed Societies*	Australia	1976*	1973
Weed Science Society of China	China	1981	1989
Korean Society of Weed Science	South Korea	1981	1989
Malaysian Plant Protection Society	Malaysia	1976	1989
Pakistan Weed Science Society	Pakistan	1987	1989
Weed Science Society of the Philippines	Philippines	1968	1989
Weed Science Society of the Republic of China	China (Taiwan)	1980	1989
Weed Science Society of Thailand	Thailand	1971	1989
Weed Science Society of Vietnam	Vietnam	1997	1997
Weed Science Society of Sri Lanka	Sri Lanka	1990	1999
Weed Science Society of Bangladesh	Bangladesh	2008	2008
Weed Science Society of Israel	Israel	1964	2015
Iranian Society of Weed Science	Iran	1950	2015

* **Notes:** Under the auspices of the Australian Agricultural Council, the first Weed Science Society in Australia - the *Weed Society of New South Wales*, was formed in 1966, a year before APWSS was formed (Chandrasena and Rao, 2017). The Australian Council of Weed Science Societies (CAWSS) was formed in 1976; however, its members who attended the early APWSS Conferences may have been affiliated with APWSS in 1973. In 2003, the name changed to Council of Australian Weed Societies (CAWS).

The Asian-Pacific region is rather loosely defined. The following is intended to only assist readers and is not an exhaustive listing of countries. Major countries that are not yet affiliated to APWSS, which spring to mind include: Myanmar, Laos, Cambodia and Mongolia and are several Melanesian countries (Fiji, Papua New Guinea, Solomon Islands and Vanavatu). In addition, other independent nations in Polynesia (Samoa, Tonga) and Micronesia (Micronesia, Marshall Islands, Palau, Nauru) are not affiliated. As the APWSS is already affiliated with Weed Science Societies in Iran and Israel, which are considered part of the Asian-Pacific region, it can attract several other countries west of Pakistan, which, among others, would include Afghanistan, Turkey, Iraq, Lebanon, Jordan and Syria.

Why National Societies are important

Weed Science Societies that have been formed in many developing and developed countries, stimulate dialogue and cooperation among the many non-specialists and the relatively few specialists directly working to control weeds (Burrill, 1982). The societies in their respective countries, have the responsibility of organizing local, national or regional conferences, to stimulate discussion on the progress made in weed control in their own country and establish linkages to other parts of the world. This objective requires vision, and a commitment to a good cause. Having a global or regional outlook is critically important because weeds are spread by worldwide trade and traffic. Nor do weeds respect national borders.

In Burrill's opinion, the organization and management of a professional society is something that requires little prior experience, but it needs a few highly committed people. A Society, such as the APWSS, is an organized group of people, joined by a common interest. In our case, what binds us is the interest in scientific inquiries on weeds, and ultimately, the effective management of weeds for the benefit of farmers, the society at large, and the environment. Organizing a dedicated group in developing countries is difficult because it needs a significant number of trained specialists who are committed to the task and financial resources, as well as governmental and industry support (Nimal Chandrasena, *pers. comm.*, June 2019).

The proportion of the contribution of agriculture to a country's economy is also an essential factor. If this portion is small, there is less interest in forming a professional body that represents a significant obstacle (such as weeds) to managing a country's agriculture. In some countries in our region, such as Australia, India, Indonesia, Japan, Malaysia, Philippines, Thailand, and Vietnam, there is significant interest in investing money in developing their workforces, to support well-established and quite advanced agricultural production bases. In the most advanced and technology or mining-dominated economies, such as USA, Australia, Japan, and South Korea, the percent contribution of agriculture to the country's gross domestic product (GDP) could be as low as 1.0% (USA) or relatively low figures (2-4%). In sharp contrast, in some developing countries, such as Bangladesh, Pakistan, and Indonesia, this figure is quite high (about 20-25%).

A few countries in our region fall in between with about 8-13% contribution of agriculture to GDP (examples are Sri Lanka, Malaysia, Thailand). In my view, workforces, including Weed Scientists and related land managers, would benefit significantly by the knowledge-sharing and coordinated efforts that can be promoted, achieved and maintained through a Weed Society or a Plant Protection Society. The interest in individual countries can significantly vary, as we have witnessed in the APWSS, according to, among other factors, political stability, governance, and organizational maturity.

A few interested and highly committed people need to play an essential role in organizing a Weed Science Society at the beginning. Again, we have the examples of several founders of APWSS whose efforts have been well documented elsewhere (see Chandrasena and Rao, 2017; and the Special Editorial in this issue). It might be true for countries, which have not yet formed or organized a Weed Science Society, and which may be lacking such highly committed or interested people related to Weed Science. In my view, some countries might have only a few concerned weed scientists, but they may not be able to organize a dedicated, professional Weed Science Society, because they lack governmental and industry support and knowledge about the necessary process, which involves surveying interested stakeholders and gauging the public interest. In such situations, how could APWSS help to create the interest and train or develop highly committed people in countries that are currently unaffiliated to APWSS?

Approaches to assisting others

There are several approaches that I propose to help other countries and their Weed Scientists. The first one has to be the training of a selected group of people in the region's countries, which already have well-established Societies and weed Science programmes. This objective may take the shape of short- or long-training courses or degree programs. The other option might be the training of select participants 'on-the-spot', in their own countries and native environments, through well-planned seminars, workshops, and symposia held on a regional basis.

Thus far, international organizations, such as the Food and Agriculture Organization (FAO), have played significant roles directly in agricultural

development in the world. In recent years, due to budget restrictions, the FAO has rolled back their involvement in many areas, including Weed Science. There is currently no dedicated Weed Science Principal Officer at the FAO. As shown by the FAO Website (FAO, 2019), the Plant Production and Protection Division (AGP) supports countries in the transition to sustainable crop production systems. AGP works with countries and a broad range of partners in developing and promoting agroecological approaches to sustainable crop production, building on ecosystem services while enhancing and protecting the underlying natural resource bases. Their current work appears to focus on areas, such as sustainable crop intensification, pest, and pesticide management systems; seeds and genetic resources; and more holistic ecosystem management. Weeds are almost 'hidden' inside the Biodiversity, Environment, and Ecosystem Themes.

While the areas and themes promoted by the FAO (2019) are important, in this scenario, unlike in the past, it has been difficult for the FAO to initiate a seminar, workshop or symposium, related to Weed Science. This deficiency leads to the question: Who can initiate or support these kinds of activities in the Asian-Pacific region? By not focussing on areas, such as weeds more directly, there is a significant risk for both agriculture and the environment in our region. To implement this objective, I suggest, first of all, the Executive Committee of APWSS has to play a role in helping to organize the formation of national Weed Science Societies in those countries that have no such body in Asian-Pacific region. Second, it would be meaningful to survey how many countries are an unaffiliated member to APWSS. Third, it would be necessary to identify the right persons in those countries to be trained in Weed Science. Fourth, we must try to understand the situations in those countries that have resulted in little or no progress, although APWSS has existed for more than 50 years.

In the beginning, I suggest that an umbrella organization, such as the APWSS, should focus on the countries, which may, with a little help, be able to organize within their countries a national body to represent the Weed Science community. This task requires identifying governmental and industry stakeholders who are eager to participate in such a venture. Furthermore, for implementing this objective and approach, it would be meaningful to get help from many retired Weed Scientists in the Asian-Pacific Region who can voluntarily participate in this matter and help other scientists and countries.

Opportunities and Constraints

My experience is that it is rather difficult for some countries to obtain funds for organizing a national Weed Science Society. Many people believe that weeds are not of much importance, compared with insects or plant diseases in terms of crop damage or yield reductions.

Of course, I think, this may not be true in all circumstances of crop production. If one looked hard enough, we are more than likely to encounter new weeds and weed-related, new land management problems in the region. Some of these challenges were recently highlighted by Adkins (2017). Among the new threats he identified, with which I agree, are the following:

1. Weedy rice or red rice (*Oryza sativa* L.) - first noted in 1988, weedy rice has now become a challenging weed in rice production systems in several of the south, southeast, and eastern Asian countries; 'weedy' rice varieties have a shorter life span and a taller stature;
2. Parthenium weed (*Parthenium hysterophorus* L.), which inflicts losses in rangeland production, crop production and natural environment, in addition to causing human and animal diseases;
3. Mikania vine (*Mikania micrantha* Kunth. ex. H.B.K) - one of the most invasive plants worldwide, which has become a damaging weeds of the natural environment, and also a problem weed in plantation and field crops;
4. Global transfer of weeds by human-induced spread, due to internationalization; and
5. Development of herbicide-resistant weeds, as indicated by Ian Heap's website; there are currently 500 unique cases (species x site of action) of herbicide resistant weeds globally, with 256 species (149 dicotyledonous and 107 monocotyledonous plants). Weeds have evolved resistance to 23 of the 26 known herbicide sites of action and to 167 different herbicides. Herbicide resistant weeds have been reported in 93 crops in 70 countries (Heap, 2019). The number of new cases of herbicide resistance is increasing by 25% per year.

In countries, which do not have well-formed professional bodies, the above problems need to be identified and addressed without delay. We must help in this process by surveying how many countries in

the region have not yet organized a national Weed Science Society in their countries. Once this information is known, it may be possible to help such countries to organize such a Society. Countries could be categorized into different tiers depending on the strengths of their organizational capacities and educational level of people who might be professionals in agriculture and related fields. As indicated in the above, the first-tier countries, which do not need any further assistance, because they are already very well established, could offer help to other neighbouring countries in achieving this objective.

JICA (Japan International Cooperation Agency) and KOICA (Korea International Cooperation Agency) are two donor sources that are committed to poverty alleviation in the region. In addition to those agencies, there may be other donors in other developed countries, such as Australia's AusAID, or international agencies, such as the FAO. Two or three unaffiliated countries could collaborate, recommended by the APWSS Executive, and propose how they could work together to improve weed management technology in their countries, through surveys of problem weeds, holding seminars, workshops or symposia, etc. These individual countries would need to have a coordinated approach, clear objectives, and seek funding from one or more of the donor agencies.

In my view, there is a great need to help such countries to prepare a concept paper to get fund from donor agencies. For implementing this purpose, retired weed scientists from universities and government organizations in the Asian-Pacific region may be able to play a role, particularly if they have the previous experience in conducting training, capacity building and human resource development in the Asian-Pacific region.

Conclusions

A half-century has passed after APWSS became established in 1967. Considering the passage of time, I have often wondered why the number of affiliated countries with APWSS is only 18. This fact implies that there might be a significant number of unaffiliated countries to APWSS in Asian-Pacific region. In those unaffiliated countries, we would like to know that there are weed scientists and other land management professionals who can organize themselves to form national Weed Science Societies.

To answer these questions, I propose that APWSS should take the initiative to form a research

group under its Executive, to broaden and extend assistance to the unaffiliated countries. This initiative should start with a survey to establish how many countries have not yet formed a national Weed Science Society and how many weed scientists or agronomists are doing Weed Science work in these countries.

We must also gauge the interest of government agencies and organizations in those countries, which may not have very well-developed national policies on agriculture and the environment. This approach might be a kind of the right way to start a journey towards a "weed-literate" society from a "weed-illiterate" society in the Asian-Pacific region (Nimal Chandrasena, *pers. comm.*, 10 June 2019).

Thus, in my view, we must help advanced weed control technologies to reach unaffiliated countries to APWSS in the Asian-Pacific Region finally. To implement a programme, such as this, we need to select and train a few interested and highly committed people in Weed Science in each selected country. Second, the funding required for carrying out a programme such as this should be obtained from international donor sources. A planned approach is needed for fundraising, and training of interested and highly committed people, who will eventually form an effective and useful, professional body, which can drive a national agenda in the countries, currently unaffiliated to the APWSS in this region.

At this moment, as we launch a new Journal, dedicated to weeds and Weed Science, APWSS is taking a significant step and expanding its contribution to knowledge-sharing and networking throughout the region. This initiative is a new development for the APWSS that our founders would deeply appreciate.

As the Society is now quite mature, having celebrated more than 50 years of its existence, my primary message is that APWSS should continue to expand its role in the region by casting a wider net. As I propose, this can be through organizing Conference, Workshops, Training Courses, or Seminars, which can focus on solving the immediate problems of developing countries that have not yet benefitted from the Society. Not to do so will put food production and environmental protection in those countries and the broader region at peril, as the population increases, and land becomes scarcer.

I am encouraged to hear from the APWSS officials (Nimal Chandrasena, *pers. comm.*, 15 June 2019) that efforts are underway to organize such events and also to provide additional training to the junior Weed Scientists who are allied to the Society.

By extending a helping hand to those countries not yet affiliated to our Society, we would be making a significant contribution to the noble objectives that led to the founding of the Society in 1969.

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