

Building capacity for weed management in the Lao PDR

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Summary Weed control in crops, mainly hand-weeding and hoeing, has traditionally been managed by women on small-holder farms. This is unsustainable due to labour scarcity, and this limits the adoption of productive systems in the Lao Peoples Democratic Republic (PDR). Herbicides are available but knowledge on careful and effective chemical use is virtually non-existent. In addition, policies on the effective use of herbicides are needed to minimise environmental and health risks. For these reasons there is a need to build capacity in weed management and integrate non-chemical practices with new herbicidal options as they become available.

The Crawford Fund has made a significant contribution to capacity-building in crop pest and disease management, and the aim is to extend this to weed management. Australian Government volunteers have worked in this program at specific locations with farmers and local government advisers and with support from key mentors. This paper recommends the key priorities for increasing capacity in weed management practices and policies. Furthermore, feed-back from volunteers provides guidance on ways to improve the professional and personal outcomes of the volunteering experience.

Keywords Integrated weed management, small-holder farmers, volunteer support, government regulation.

INTRODUCTION

Laos is one of the least developed countries in East Asia. It is land-locked between Vietnam, Thailand, China, Myanmar and Cambodia with a population of around seven million people. Subsistence agriculture is practised by 80% of the population and accounts for 50% of the country's Gross Domestic Product. Foreign aid provides a significant support to agricultural

development and the economy. Although poverty has been reduced in recent years, malnutrition in children is still a concern. Rice is the main crop, with about 80% of the arable land area used for growing rice by small-holder farmers.

Approximately 77% of Lao farm households are self-sufficient in rice for domestic consumption. Vegetables are also important for domestic consumption as well as for cash crops.

Weeds reduce crop yield and quality, degrade pastures, host pests and diseases, and decrease biodiversity of natural ecosystems, all of which can have negative economic impacts. These costs have not been well quantified in the Lao Peoples Democratic Republic (PDR), and so it is difficult to engender support for improved practices and policies for weed management.

For some years, the Crawford Fund (www.crawfordfund.org) in collaboration with Australian Government-funded volunteers in the Australian Volunteers for International Development (AVID) program, has supported capacity-building for crop pest and disease management in a range of rice, fruit and vegetable crops (e.g. Ireland 2014, Ireland *et al.* 2016). A scoping study was undertaken in November 2016, mainly in vegetables, and to a lesser extent rice, to assess the need to extend the capacity building to include weeds (Lemerle 2017). In addition, previous experience with AVID volunteers was assessed as a basis for optimising the recruitment of volunteers to work in weed management in the future.

NEED FOR BUILDING CAPACITY IN PRACTICES

The scoping study involved visits to representative arable areas in the southern region in Savannakhet and Champasak Provinces. Activities included: a) field tours using weed identification field guides (Martin

and Chanthy 2007, Caton *et al.* 2010) and expert assistance (R. Martin, pers. comm.) to identify the most common species; and b) discussions with ‘leading’ farmers and provincial and district staff about priority weed species, current management practices, and needs for the future.

The weed flora in vegetable crops (e.g. cabbage, watermelon, long-bean, eggplant, tomato and chilli) is generally very diverse. Many species are common in both lowland and highland areas, mainly in the Asteraceae, Amaranthaceae, Fabaceae and Poaceae families. Symptoms of diseases, viruses and pests were observed on some weed species, an indication of the importance of weeds as foci of infection and spread. The most common and abundant species observed in dry-season rice crops (transplanted, broadcast and direct seeded) were barnyard grasses (*Echinochola* spp.), various sedges (*Cyperus* spp. and *Fimbristylis* spp.), and a broad-leaf water primrose (*Ludwigia octovalvis* (Jacq.) P.H. Raven).

Farmers’ and government staff’s knowledge of weed identification and management is variable. Many plant species are considered both weeds and useful (for wild-harvest food, medicinal uses, and grazing). The economic cost of weeds is often not recognised leading to low levels of management, especially in vegetable crops. The main weed control management practices followed by farmers are traditional non-chemical practices such as hand-weeding, hoeing, cultivation, cutting, rotations, burning and grazing. However, many farmers want mechanisation and herbicides for weed control to save labour and speed up operations. Herbicide use by small-holder farmers is low due to lack of availability and registration of products in Laos. Some products have been imported from Thailand, Vietnam and China through registered traders, but there is no labelling in the local language so farmers cannot read application instructions. The demand for chemical control is growing with declining labour availability. Glyphosate is available for non-selective and pre-planting weed control in the larger regional centres, but there has been no research or extension on potential applications of selective herbicides.

The priority needs for weed management in crops as identified by provincial and district advisory staff and farmers is rice followed by vegetables. The development of drilled and dry-seeding in rice which is intended to save labour and water, will exacerbate weed problems. This will lead to even greater future need for capacity in integrated weed management (IWM) (Matloob *et al.* 2015, Kumar *et al.* 2017). Components of IWM for rice (Kumar *et al.* 2017) and other crops include:

- promoting ‘fatal germination’ of weeds using stale seedbed techniques;
- using clean seeds, such as certified seeds free from weed seed contamination;
- managing fallows to prevent weed seed production;
- using soil mulch and crop residue mulch for weed suppression;
- improving crop competitiveness against weeds by choice of cultivar, adjusting water (in rice) and nutrient management, and manipulating seed rate and crop geometry;
- rotating crops and establishment methods;
- utilising grazing by animals, and ‘cutting and carrying’ weeds for animal food;
- using mechanical tools and need-based hand weeding to remove escaped weeds and prevent seed production; and
- using appropriate herbicides and their combinations.

In summary, the key activities and resources needed in Laos for sustainable weed management include: research and development for cost-effective IWM strategies and practices; correct weed identification and herbarium facilities; training and extension materials for small-holder farmers and advisers in the Lao language; quantification of the costs of weeds to farmers and the broader impact of weeds to Lao economy; and effective policy and regulation for herbicide distribution and usage.

POLICY CONTEXT

The Lao Department of Agriculture has been proactive in providing an effective policy framework for plant protection through promulgation of the new Law on Plant Protection and Quarantine. This law is primarily focused on providing a contemporary and comparable world-class legislative basis for policy formulation and action to protect crops from pests and diseases, along with mechanisms to prevent the introduction of new pests and diseases into the country. In addition, the scope of policy and action under this law could be readily expanded to cover other areas of action to combat the economic and environmental impacts of weeds. However, there is still a considerable support needed to provide a suitable regulatory and policy environment for this law to achieve its desired outcomes.

The need for enhanced crop protection has to match the increasing recognition to produce crops free from unacceptable levels of chemical residues. There has recently been a concerted effort to manage agricultural chemical use responsibly and safely. Programs such as the Good Agricultural Practices

(GAP), developed under the framework of the Lao-Thai-German Trilateral Cooperation Programme, and the ASEAN Sustainable Agrifood Systems, are increasing awareness of, and commitment to responsible chemical use. Lao PDR expects to increase the number of GAP farms from 300 in 2016 to 100,000 in 2020. This indicates the priority given by the Government to reach food security and safety. This increased level of landholder adherence to GAP will clearly need considerable financial and policy commitment from the Government.

VOLUNTEERS FOR BUILDING CAPACITY

The clustering of AVID volunteers on assignment for 12 months with appropriate mentors has previously focused on plant pests and diseases. This will be extended to include weeds. However, there is variation in the benefits of, and risks to, deploying international volunteers (e.g. retirees, students, people on vacation) for capacity building in Laos. Volunteers with different skills at specific locations, can achieve synergies, on-going continuity, and economically sustainable support. In addition, they can value-add to Australian (or other country) aid from other agencies such as the Australian Centre of International Agricultural Research (ACIAR), universities, and state governments.

The professional and personal experiences gained, as identified by volunteers, include:

- improved knowledge of local small-holder farming systems, constraints to production at a subsistence level, and the options available to improve their livelihoods;
- exposure to a broader range of pathogens, pests, crops, and farming techniques than would normally be experienced;
- building one's skills and knowledge quickly to work independently, perform under challenging conditions, learn problem solving techniques with minimal resources, teaching, project management and negotiation, and improving communication skills to interact with people from different cultures, languages and educational backgrounds;
- having a mentor providing support and encouragement, helping in identifying key priorities and pests, and encouraging career development;
- working in an environment with an established infrastructure, networks and knowledge built up over the duration of the Crawford program in Laos;
- enjoyment of working with a diverse range of highly motivated colleagues, and developing personal and professional relationships and networks, in a culturally and socially different country;
- an opportunity for 'time out' to broaden personal and professional horizons; and

- knowing, from feedback, that the volunteer work is making a difference in the livelihood for farmers in Laos.

Ways to make the volunteering experience and assignment more effective and enjoyable also need to be identified. Success is underpinned by providing volunteers with sufficient support through strong links and effective communication between the partner organisations in Australia and Laos. The strong commitment of volunteer, mentor and host organisation in Laos is essential, as are clearly defined roles and responsibilities, with structured goals and activities, for all involved. High expectations of the outputs from volunteers, who are constrained by time and inadequate provision of required resources, can cause difficulties to achieve the desired outputs. On-going monitoring and flexibility is required as assignments might change and each party should be kept up-to-date. Volunteers need to be adequately prepared prior to placement; this could include language training, streamlining administrative processes (including visas), and pre-departure connections established with peers working on similar projects. Finally, consideration and planning are needed to help volunteers return to their workplace in Australia following completion of an assignment.

CONCLUSIONS

We have a good opportunity in Laos to gradually, but significantly improve the quality and productivity of farming systems by increasing farmers' capacity to manage weeds. This includes optimising the introduction of herbicides where appropriate, and their integration with non-chemical options for IWM. This will reduce the risks of developing significant problems of herbicide resistance, and chemical residues in food, the environment (soil, water, air, biodiverse) as well as human and animal health issues, that are prevalent in other Asian countries. There is also an opportunity to utilise the beneficial properties of weeds when developing management strategies. Capacity building with volunteers and mentors grouped at specific locations has proven effective for supporting farmers and advisers. This can value-add to research and development projects (e.g. ACIAR), universities, and other public and private sector organisations. The overall aim is to increase farm profitability, reduce poverty and poor human nutrition, and enhance healthy and sustainable food production systems.

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REFERENCES

- Caton, B.P., Mortimer M., Hill, J.E., Johnson, D.E. (2010). 'A practical field guide to weeds of rice in Asia.' Second Edition. (International Rice Research Institute, Los Baños (Philippines). 118 pp.
- Ireland, K.B. (2014). 'Building capacity to combat crop diseases in Laos to improve agriculture'. (Scope Global and Department of Foreign Affairs and Trade (DFAT). Blog post for Australian Volunteers for International Development (AVID). <http://www.australianaidvolunteers.gov.au/meet-the-volunteers/case-studies/building-capacity-to-combat-crop-diseases-in-laos-to-improve-agriculture.aspx> (accessed 6 August 2018).
- Ireland, K.B., Weir, B.S., Cother, E.J., Phantavong, S., Phitsanoukane, P., Vongvichid, K., Vongphachanh, P.P., Songvilay, P., Chittarath, K., Sayapatha, S., Walsh, J., Turner, S., Park, D., Tesoriero, L.A., Vilavong, S., Duckitt, G.S. and Burgess, L.W. (2016). First report of *Ralstonia pseudosolanacearum* in the Lao PDR. *Australasian Plant Disease Notes* 11, 36.
- Kumar, V., Opena, J., Valencia, K., Le Thi, H., Nguyen, H.S., Donayre, D.K., Janiya, J. and Johnson, D.E. (2017). Rice weed management in southeast Asia. In 'Weed management in rice in the Asian-Pacific region', eds A.N. Rao and H. Matsumoto, pp. 282-307. (Asian-Pacific Weed Science Society, The Weed Science Society of Japan, and The Indian Society of Weed Science, India).
- Lemerle, D. (2017). Opportunities for capacity building in weed management – Lao PDR. Proceedings of the 26th Asian-Pacific Weed Science pp. 158. (Asian-Pacific Weed Science Society, Kyoto, Japan).
- Martin, R. and Chanthy, P. (2007). 'Weeds of upland crops in Cambodia' (New South Wales Department of Primary Industries, Orange).
- Matloob, A., Khaliq, A. and Chauhan, B.S. (2015). Weeds of direct-seeded rice in Asia: Problems and opportunities. *Advances in Agronomy* 130, 291-336.