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Strategies for promoting the adoption of sustainable pest management techniques in tropical vegetable production

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Smallholder agriculture is undergoing rapid change toward more intensive production of horticultural crops in many developing countries in tropical Asia and Africa. Vegetables, an important source of human nutrition, are cultivated on 4.80 million ha with annual production of 59.25 million t in South Asia and Southeast Asia. Insect pests and diseases can cause severe yield loss in vegetable crops in the tropics; growers generally resort to indiscriminate, repeated application of chemical pesticides in an attempt to protect their crops. The use of pesticides has increased, especially in countries experiencing rapid economic growth. Chemical pesticides account for one-third to one-half of the total material input cost for vegetable production in the region. Extensive and inappropriate pesticide use has led to pests developing resistance to major groups of pesticides and resurgence of secondary pests, triggering pesticide overuse. Adverse effects on human and environmental health resulting from unchecked pesticide use include chemical residue on produce, farmers repeatedly exposed to chemicals, and loss of biodiversity.

Integrated pest management (IPM) techniques often have been suggested as an alternative to chemical pesticides. Although various IPM packages have been developed and promoted for vegetables, adoption remains low. This brief will propose strategies to promote the adoption of IPM techniques to mitigate the ill-effects caused by pesticide misuse and overuse.

Over-reliance on chemical pesticides occurs for several reasons. Pesticides tend to be highly effective and address a broad spectrum of pests; they are easy to obtain, relatively inexpensive, and easy to apply. Any IPM package aiming to supplant a pesticide should be equally simple, effective and economical to use. However, most IPM packages are perceived as being less effective in managing insect pests compared with chemical pesticides. This is partly due to the fact that IPM component techniques are narrow in action. For instance, sex pheromones are very specific to a particular insect pest species, and bio-pesticides such as *Bacillus thuringiensis* are effective only against a narrow range of pests (e.g., lepidopterans).

Although IPM packages have been designed with multiple component techniques targeting different pests and plant diseases, in many cases they are unable to provide a complete solution. IPM has been promoted as a combination of techniques without giving due consideration to the compatibility of each component. This is especially true when chemical pesticides are included in an IPM package. Different deployment strategies should be developed when integrating pesticides into an IPM package. For instance, natural enemies would not come into direct contact with harmful chemical pesticides if the pesticides were delivered through seed, or as a seedling treatment.

IPM packages should include several highly effective, broad spectrum components to tackle a range of pests and plant diseases for a particular vegetable crop. These component techniques may vary depending on the stage of the crop, as the pest and plant disease profile changes with the growth stages of the crop. Farmers should be informed if an IPM package has been designed for a particular crop stage. If an IPM package is promoted as a 'one-time' recommendation for the entire crop cycle, it might appear to be too complex to apply, and farmers might refrain from adopting the package.

Currently, few IPM components are commercially available in South and Southeast Asia. For instance, although bio-pesticides are a major component of any IPM package, they account for only about 4% of the global pesticide market. With such a small market share for bio-pesticides, private sector companies prefer to focus their marketing and promotion efforts on chemical pesticides.

Nevertheless, active engagement of the private sector is essential to commercialize IPM components such as microbial pesticides and pheromones. Private sector interest in bio-pesticides is gradually increasing, but inadequate or missing regulatory frameworks prevent the manufacture, import, registration and use of bio-pesticides in South and Southeast Asia. Strengthening regulatory frameworks will increase the commercialization of IPM components and lead to large-scale adoption of IPM packages at national levels. This has occurred in India, where the Central Insecticides Board (CIB) has helped to spread the use of bio-pesticides in the promotion of IPM. The CIB simplified the registration system to allow commercial pilot bio-pesticide production in parallel with registration, which is encouraging the creation of small and medium IPM component manufacturing enterprises. In Bangladesh, the participation of the private sector in commercializing bio-pesticides, including pheromones, is increasing. Bringing multiple players into the business eventually will lead to a reduction in the cost of bio-pesticides and pheromones, making them more affordable to small-scale vegetable farmers in the region.

Finally, capacity building is imperative for large-scale promotion and adoption of IPM packages. Farmers, public and private extension system staff, and agro-input retailers should be educated on the broader impacts of IPM in addition to the immediate returns IPM can provide for a particular vegetable crop. To have a sustainable production system and a healthier society, these actors in the vegetable value chain must understand the health and environmental costs associated with pesticide misuse and overuse, because they mostly concentrate on the immediate returns from the crop. Consumers also must be made aware of how their demand for blemish-free, visually attractive vegetables puts pressure on farmers to use too much pesticide in pursuit of perfection.

Dr. SRINIVASAN RAMASAMY has nine years of agricultural research experience as a Vegetable Entomologist, successful author and co-author of grant proposals. He has been heading the Entomology Group at AVRDC – The World Vegetable Center since 2005 with professional interests in host-plant resistance, chemical ecology of insect pests, biological control and integrated pest management in tropical vegetable production. He has received several awards including the *International Plant Protection Award of Distinction* (Team Award for AVRDC's Plant Protection and Breeding groups). He is an active member in professional societies such as Royal Entomological Society, Society for Invertebrate Pathology, Entomological Society of America, International Association for the Plant Protection Sciences and Taiwan Entomological Society. He has more than 60 publications to his credit. He is the Steering Committee Member in CGIAR System-wide Program on Integrated Pest Management (SP-IPM) and Editorial Board Member for the *Journal of Biopesticides and Green Farming*.