Symposium on Horticultural Science
18th March, 2016 at RUA, Phnom Penh, Cambodia.

Development of IPM strategies on field insect pests of cruciferous vegetables (Brassica spp.)

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Introduction

• Around 16 insect species have been reported on cruciferous vegetables in Cambodia (CABI, 2007; GDA and JICA, 2011).

• Eng et al, 2015 and Soeum et al, 2015 have found that farmers in Kandal and Battambang province sprayed a mixture of 4-6 pesticides with at least 3 pesticide applications weekly.
What’s in the media?

The Phnom Penh Post

Worries over pesticide use

Tue, 11 January 2011 Rebecca Puddy and Khouth Sophak Chakrya

WHEN Yorn Makara sprays pesticides on his morning glory crop at Boeung Tompun lake, on the outskirts of Phnom Penh, he copies how his parents once used the chemicals, because he can’t read the instructions on the bottle.

“I buy pesticides and chemicals to mix in a container with water and the instructions are mostly written in the Thai or Vietnamese languages,” Yorn Makara says. “I know the chemical protects my crops from pests because I look at the pictures on the bottle.”

While Yorn Makara knows the pesticides are effective at killing pests, he can’t be certain of the dangers the pesticide poses to his health, as he can’t read the safety information.

According to a new study on pesticide use in Phnom Penh, Yorn Makara is not alone.

The study, conducted by researchers at the University of Copenhagen in Denmark, found most farmers at neighbouring Boeung Cheung Ek lake had a limited understanding of how to protect themselves from dangerous pesticides, resulting in 88 percent of those surveyed reporting symptoms of acute pesticide poisoning.

“The main issue we uncovered in BCE lake was the heavy and frequent use of pesticides which have been banned or restricted by the Cambodian government,” said Hanne Klith Jensen, head researcher of the study which focussed on the farming practices of morning glory aquaculture farmers in Thnout Chrum and Kba Tumnub villages.

What’s in the media?

Pesticides Continue to Harm Cambodia’s Farmers

http://bit.ly/1N9vL3K

A new study shows that many Cambodian vegetable farmers suffer from acute pesticide poisoning. It is the latest to indicate that Cambodia, like many other developing nations, is struggling to protect farmers and consumers from the dangers of pesticides.

http://bit.ly/1hEbYwz
Introduction

- Ecological damage due to widespread use of synthesis pesticides (Antonious, 2003; 2004).
- Pesticide contamination problems (Wang et al, 2011; Neufeld et al., 2010)
Introduction

• Tomato, clover and onion have been studied as intercropping with cruciferous vegetables extensively while lemongrass, sweet basil, holy basil and green onions are relatively low.
Materials and Methods

Dry season in 2015
Materials and Methods

- **Experimental design**
  - 2014 treatments: lemongrass (*Cymbopogon citratus*), green onions (*Allium fistulosum*), sweet basil (*Ocimum basilicum*) and non-barrier
  - 2015 treatments: sweet basil, holy basil (*O. tenuiflorum*), yellow sticky trap, plastic barrier and non-barrier
Materials and Methods

- Sampling method

Olympus SZ61 microscope equipped with CANON EOS 1100D camera
Materials and Methods

Scoring holes on leave

• Score 0: no damage
• Score 1: 1%
• Score 2: 2-5%
• Score 3: 6-10%
• Score 4: 11-30%
• Score 5: >30%

Kianmatee and Ranamukhaarachchi, 2007
Results and discussion

- Occurrence of insect pests in the dry season of 2014 and 2015

<table>
<thead>
<tr>
<th>Order</th>
<th>Family</th>
<th>Scientific name</th>
<th>English name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coleoptera</td>
<td>Chrysomelidae</td>
<td><em>Phyllotreta striolata</em>[^1,^2]</td>
<td>Cabbage flea beetle</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Liriomyza sp.</em>[^2]</td>
<td>Leaf miner</td>
</tr>
<tr>
<td>Diptera</td>
<td>Agromyzidae</td>
<td><em>Hellula undalis</em>[^1,^2]</td>
<td>Webworm moth</td>
</tr>
<tr>
<td>Lepidoptera</td>
<td>Crambidae</td>
<td><em>Spodoptera spp.</em>[^1]</td>
<td>Army worm</td>
</tr>
<tr>
<td>Lepidoptera</td>
<td>Noctuidae</td>
<td><em>Agrotis sp.</em></td>
<td>Cutworm</td>
</tr>
<tr>
<td>Lepidoptera</td>
<td>Noctuidae</td>
<td><em>Trichoplusia ni</em>[^1]</td>
<td>Cabbage looper</td>
</tr>
<tr>
<td>Lepidoptera</td>
<td>Noctuidae</td>
<td><em>Plutella xylostella</em>[^1,^2]</td>
<td>Diamondback moth</td>
</tr>
<tr>
<td>Lepidoptera</td>
<td>Plutellidae</td>
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</tr>
</tbody>
</table>
Results and discussion

• Abundance of insect pests in the dry season of 2014 and 2015

2014

2015
Results and discussion

• Pliny the Younger (23-79AD) wrote in his *Naturalis Historiae* that when rape (*Brassica napus* L.) and vetch (*Vicia sativa* L.) were grown together, many insects that occurred normally on these plants were not found (Schoonhoven et al., 1998).

• Reduce primarily colonization (odors emanating from nonhost plant may also disrupted the attraction of pests to host plants – Finch et al, 2003; Finch & Collier, 2000; Finch, 1996; Vandermeer, 1989; Root, 1973).
Results and discussion

- Population of *P. striolata* increase in monoculture and decrease in diculture with non-host (Weiss, 1994; Garcia and Altieri, 1992; Elmstrom et al, 1988) except lemongrass.

- Plants with aromatic quality contain volatile oils that may interfere with host plant location, feeding, distribution and mating, resulting in decreased pest abundance (Lu et al, 2007; Stan et al, 2003; Uvah and Coaker, 1984; Tahvanainen & Root, 1972)
Results and discussion

- Sweet basil had the lowest number of *P. striolata* and *Hellula undalis* while Lemongrass had the lowest number of *Spodoptera spp.* (Kianmatee and Rana mukhaarachchi, 2007)

- Neave et al (2011) used exclusion net successfully for pest management on cabbage in the Solomon Islands. Asman et al (2001) have concluded that the high barriers could possibly reduce the spread of *P. xylostella*.

- Yellow sticky trap could be used partially to control *P. xylostella* (Rushtapakomchait et al, 1990)
Results and discussion

- Allium species (onion) intercropping with cruciferous vegetables and reduce *Hellula undalis* (Debra and Misheck, 2014; Baidoo et al, 2012), flea beetle (Gao et al, 2004) but not *Plutella xylostella*. 
Results and discussion

- Indication of crop growth in 2014

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Plant height (cm)</th>
<th>Leaves number/plant</th>
<th>Weight/plant (g)</th>
<th>Leaf area (cm²)</th>
<th>% of damaged leaf area (score)</th>
<th>Undamaged yield (t/ha)</th>
<th>Damage yield (t/ha)</th>
<th>Total yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>18.35</td>
<td>5.3b</td>
<td>83.5b</td>
<td>112.925</td>
<td>3.5a</td>
<td>13.9375c</td>
<td>2.4375ab</td>
<td>16.375b</td>
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<tr>
<td>Lemon grass</td>
<td>21.9</td>
<td>5.65ab</td>
<td>87.45ab</td>
<td>118.44</td>
<td>2b</td>
<td>14.55bc</td>
<td>2.575ab</td>
<td>17.125b</td>
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<tr>
<td>Green onions</td>
<td>23.45</td>
<td>5.95a</td>
<td>91.275a</td>
<td>132.45</td>
<td>2b</td>
<td>17.3125a</td>
<td>2.6875a</td>
<td>20a</td>
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<tr>
<td>Sweet basil</td>
<td>22.6</td>
<td>5.65ab</td>
<td>89.4a</td>
<td>131.55</td>
<td>2b</td>
<td>16.775ab</td>
<td>1.85b</td>
<td>18.625ab</td>
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<tr>
<td>ANOVA</td>
<td>ns</td>
<td>*</td>
<td>*</td>
<td>ns</td>
<td>**</td>
<td>*</td>
<td>*</td>
<td>*</td>
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<tr>
<td>CV</td>
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<td>6.7</td>
<td>4</td>
<td>14.68</td>
<td>20.99</td>
<td>10.98</td>
<td>19.61</td>
<td>9.78</td>
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</table>
## Results and discussion

- **Indication of crop growth in 2015**

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<th>Total yield (t/ha)</th>
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<tbody>
<tr>
<td>Control</td>
<td>29.75b</td>
<td>5.65b</td>
<td>60.35b</td>
<td>109.24b</td>
<td>3.32a</td>
<td>7.31</td>
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<td>9.31</td>
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<tr>
<td>Sweet basil</td>
<td>31.05b</td>
<td>5.45b</td>
<td>63.45b</td>
<td>114.38b</td>
<td>2.28b</td>
<td>8.33</td>
<td>1.5ab</td>
<td>9.83</td>
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<td>Holy basil</td>
<td>31.7b</td>
<td>5.9ab</td>
<td>67.65b</td>
<td>124.02b</td>
<td>2.38b</td>
<td>10.63</td>
<td>0.75bc</td>
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<td>Yellow sticky trap plastic</td>
<td>31.4b</td>
<td>5.8b</td>
<td>65.65b</td>
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<td>barrier</td>
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<td>**</td>
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<td>**</td>
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<tr>
<td>CV</td>
<td>11.30</td>
<td>10.27</td>
<td>18.30</td>
<td>21.28</td>
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<td>30.88</td>
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</tbody>
</table>
Conclusion

- Green onions, sweet basil and holy basil are potential in reducing major pests: P. xylostella, P. striolata and H. undalis while lemongrass is great in reducing Spodoptera spp.
- Non-living barrier (plastic barrier) will also be a promising management for a small farm.
- This partial management is not yet sufficient, a combination with other management options will be a good complementation.
On-going for 2016
Demonstration
Demonstration
Demonstration
Demonstration