FEEDBACK
from the field

World Vegetable Center

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**This bulletin provides information about application of the World Vegetable Center's technologies in the field and other topics of interest regarding vegetable production and consumption constraints around the world. It is issued quarterly. We welcome everyone to share any interesting news about vegetables – please send a short article with photos to tech_dissemination@worldveg.org. Thank you!**

# Simple techniques for preventing off-season tomatoes from frost injury in Pakistan

*For off-season tomato production, farmers usually start to harvest fruit at the end of October **(left)**, and set up mini-plastic tunnels before mid-December to protect tomato plants from frost damage **(right)**, in Thoha Mehram Khan village, Chakwal district*

Thoha Mehram Khan is a village in Chakwal district of Punjab province, Pakistan. Recently, most of the farming communities in this area cultivate off-season tomato for higher income from June to December under natural conditions. Determinate hybrid tomatoes are commonly grown with an average yield of 10 t/ha. However, frost is one of the major problems faced by tomato growers in December when the temperature drops below 0°C.

To avoid frost injury, growers usually harvest all the tomatoes, including immature and small-sized ones, before mid-December and pile them on the floor in a storeroom or pack them in gunny bags for ripening. Around 10-20 days later, farmers pick out the ripened tomatoes and pack them into small bags for sale. However, most tomatoes are low quality because of irregular shape and physical disorders during storage and this greatly reduces their market value.

*Under conventional practice, farmers open gunny bags and pick out ripened tomatoes for sale, however, tomato quality is low due to irregular shape and physical disorders during storage*

To protect tomato plants from frost injury, simple and cost-effective techniques were developed by the World Vegetable Center through the "Agricultural Innovation Program for Pakistan" project which is funded by the United States Agency for International Development (USAID). The International Maize and Wheat Improvement Center (CIMMYT) and the Pakistan Agricultural Research Council (PARC) are the partners for implementing the project.

In December to January, tomato plants are protected by 1 m high and 1.3 m wide **mini-plastic tunnels**. This practice not only prevents frost damage but also prolongs the crop season up to approximately two months. Plants can produce quality

*Simple nylon sheets were set up when tomato plants were 4-6 weeks old to protect the crop against frost in Faisalabad district of Punjab province*

tomatoes with regular shape and almost double the average yield. "I have earned approximately double profit than before," said tomato grower Nawazish. "Setting up the mini-tunnels over the fields also enhance the economy." An economic survey at the end of the crop season showed an additional income of US$2,647/ha for farmers who adopt this technology.

For the tomato crop planted just before the cold season, **simple nylon sheets** can be set up when plants are 4-6 weeks old, which is around the first week of December, and kept in place till mid-February for stabilizing and protecting the crop during the frost-prone days in Faisalabad district of Punjab province. Each nylon sheet is 3-4 meters long and stitched by a machine at three points to make vertical grooves which are spaced uniformly. Iron bars are inserted into the grooves and then inserted about 15 cm deep into the soil on beds at about a 60° angle opposite to the direction of oncoming frost, thus making a hood over the tomato plants. When fixing the iron bars, care is taken to keep the hood at a certain distance so that it will not touch the plants.

This simple technique ensures a plant survival rate over 90%, whereas the conventional practice of using rice straw against the frost only provides a 50% survival rate. In addition, setting up the nylon sheets instead of covering tomato plants with rice straw can save 80% on labor requirements and reduce the incidence of pests and diseases to less than 10% because of more sunlight received by the plants, better aeration and lower humidity. Moreover, rice straw attracts rodents while the nylon sheets have no such hazard. The estimated cost of nylon sheets is US$4,200/ha and they can be used for more than five years, thus the annual expenditure is US$840/ha. The nylon sheets can also be used for other vegetables with minor modifications as per crop nature.

With the protection from mini-plastic tunnels or simple nylon sheets in winter, frost damage to tomato plants can be avoided or reduced, and cropping seasons can be prolonged. The project plans to introduce and promote these protected cultivation techniques to more farmers in the coming season.

*Conventional practice using rice straw against the frost*

*Nylon sheet with inserted iron bars*

*Iron bar with tilted top*

**Source and photos:**
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# Promoting safer production of vegetable brassicas and yard-long bean in Lao PDR

*Vegetable production in peri-urban Luang Prabang*

Luang Prabang province is located in the northern part of Lao People's Democratic Republic (PDR). Luang Prabang city is the former royal capital and a UNESCO world heritage site that draws increasing numbers of tourists from across the world. Due to the preference for safer vegetables by western tourists, many restaurants and hotels in Luang Prabang demand a continuous supply of vegetables. Thus, farmers in this province produce several vegetables year-round especially in peri-urban areas where water availability for irrigation is assured. Since the Mekong River feeds Luang Prabang, the peri-urban area of this city is filled with many vegetable fields (<300 m above sea level), even during the hottest month in April (the average high temperature can reach 36°C). Pak-choi, Chinese cabbage, leafy mustard, lettuce, amaranth, celery, coriander, mint, sweet basil and others are the commonly grown vegetables during this season.

Farmers grow the crops continuously; hence one can see the same crop in varying growth stages in different plots. Striped flea beetle (*Phyllotreta striolata*) is the predominant insect on leafy brassicas, while diamondback moth (*Plutella xylostella*) and common armyworm (*Spodoptera litura*) larvae are also found. Adults of imported cabbage worm (*Pieris rapae*) are also spotted, but their population is quite low because of very high temperature.

Farmers mainly rely on chemical pesticides to control insect pests. However, a few organic farms producing leafy vegetables are also located near Luang Prabang. Farmers have given up cultivating leafy brassicas because no effective organic control options are available for managing striped flea beetle. One of the organic farms mainly produces lettuce, which does not have major insect pests and diseases.

Vegetable cultivation is also practiced on the banks of the Nam Khan River and in the neighboring fields along Highway 13 from Luang Prabang to Vang Vieng. Eggplant, cucumber, cabbage, yard-long bean, tomato, and chili are cultivated. Growers use banana boats to cross the river with their produce and sell it in small outlets along the highway. The cabbage in this area was severely infested by diamondback moth (DBM).

*Vegetable outlet along Highway 13 from Luang Prabang to Vang Vieng*

In many villages farmers are cutting down trees and shrubs to clear land through slash and burn for planting upland rice in May for the monsoon season. After harvesting rice, farmers usually mix-crop chili pepper, cabbage and shallot, and plant yard-long bean as a sole crop. Cabbage was severely infested by imported cabbage worm, striped flea beetle and DBM. Old cabbage crops were severely infected by black rot disease. Besides the legume pod borer (*Maruca vitrata*), which still remains the predominant pod borer on yard-long bean, thrips and blue butterfly were also damaging this crop. A rough estimate indicated that the infestation of *M. vitrata* was about 50%, while the blue butterfly was 5%. Cabbage,

*Cabbage fields in Kasy district, Vientiane province* ***(left)****; severe infestation of cabbage crop by imported cabbage worm in Kasy district, Vientiane province* ***(right)***

which remains the predominant brassica crop, is being grown in fields continuously, which are severely infested by *P. rapae*. In the evening hours, hundreds of adult butterflies were hovering over the fields, making it a scenic butterfly valley!

Mr. Boun My is a farmer from Vang Vieng district (adjacent to Kasy district) who maintains several plots of cabbage. Both *P. rapae* and DBM are the predominant pests on cabbage in this region. Integrated pest management (IPM) has been validated in his field. One plot has been sprayed with Lastraw™ (a formulation of organic salt, from Bio-Control Research Laboratories, India), *Bacillus thuringiensis* and Cypermethrin 35%. The *P. rapae* and DBM larval populations were quite high in plots sprayed with Lastraw™, while they were lesser in both *B. thuringiensis* and Cypermethrin sprayed plots. The dead larvae, especially *P. rapae*, can be easily found in these plots. The gregarious parasitoid of *P. rapae*, most likely *Apanteles glomeratus*, is found in plenty in Lastraw™ as well as *B. thuringiensis* sprayed plots. Although a few parasitoid cocoons are found in Cypermethrin sprayed plots, the parasitoid pupae may have been killed. Extremely high mortality of *P. rapae* was obvious in plots sprayed with Cypermethrin two days earlier. However, the neighboring plots sprayed with Cypermethrin two weeks earlier, now harbor a large population of *P. rapae*, which almost destroyed the entire field. The farmer lost hope and decided to abandon those plots. Thus, Cypermethrin treated plots might have a quick pest resurgence, although initial larval knock-down was visible. This may be indirect evidence for the elimination of the parasitoid, *A. glomeratus*, as well in Cypermethrin treated plots.

Mr. Boun My has a highly positive opinion about bio-pesticides. An IPM demonstration trial will be set up in his cabbage field within a month and a farmers' field day will be organized upon successful implementation of this IPM demonstration trial. This work is funded by the German Federal Ministry for Economic Cooperation and Development (BMZ), and implemented through the "Attraction in Action" project, which develops and promotes IPM techniques for leafy brassicas and vegetable legumes in Cambodia, Lao PDR and Vietnam.

At the end of the IPM demonstration trial, we hope to generate data on the synergistic or compatible performance of both *B. thuringiensis* and the parasitoid, which could replace the application of chemical pesticides.

*Pupa and parasitoid of* Pieris rapae; Spodoptera litura *and* Pieris rapae *infestation on cabbage; and cabbage plants treated with* Bacillus thuringiensis *in Vang Vieng district of Vientiane province* ***(from left to right)***

**Source and photos:**
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# Development of promising hybrids for tomato production in Bangladesh

*Polythene rain shelters and heat-tolerant tomato varieties are needed for off-season tomato production in Bangladesh*

Tomato is an important, delicious and nutritious crop grown all over Bangladesh, and its cultivation has become a profitable enterprise in recent years. An average of 255,000 metric tons of tomatoes are produced on 63,000 hectares of land annually. Development of off-season tomato production (May to September) is an important breakthrough to help farmers fetch higher prices during the monsoon season (See Feedback from the Field, Issue 14, pp. 1-3). Cultivating off-season tomato requires high investment, specific skills and intensive care. Therefore, farmers usually hesitate to plant; however, the profit can be excellent from high-yielding varieties.

For off-season tomato production, farmers desire early maturing, heat-tolerant and virus-tolerant/resistant varieties for good yield and longer harvesting duration.

*Fruiting plant **(left)** and ripened fruits **(right)** of heat tolerant tomato Hybrid I*

*Field evaluation trials for selecting suitable hybrids for normal season tomato production* ***(left)****; the promising hybrid BRTOM-3 showed the best performance in terms of earliness and yield* ***(right)***



To develop suitable tomato varieties that fit farmers' needs, BRAC and the World Vegetable Center have initiated a collaborative research program. The World Vegetable Center provided three heat-tolerant tomato hybrids and 23 promising lines for BRAC to evaluate their yield potential in 2012-2015.

Field trials were conducted in the extra early *rabi* season (first week of October) at BRAC Agricultural Research & Development Centre (BARDC) to assess these hybrids' potential to be grown in that season because the tomato price in the market is also high during that time.

Two hybrids (Hybrid I & Hybrid II) were found to have promising yields at 51.8 t/ha and 36.8 t/ha, respectively. Two more trials were conducted to verify their performance; in Meherpur district they both yielded 73 t/ha and in Gazipur district they yielded 54 t/ha and 91 t/ha, respectively. Some tomato growers have expressed their willingness to grow these hybrids as extra early *rabi* season hybrids.

In addition, BRAC utilized 23 promising lines from the World Vegetable Center to develop suitable hybrids for normal *rabi* season production (tomato plants transplanted in October to November). Three promising hybrids named BRTOM-1, 2 & 3 were developed and the observational yield trials were conducted during the *rabi* season in 2014-2015. BRTOM-3 showed the best performance in terms of earliness and yield (13.5% higher than the yield of two check varieties).

A demonstration plot was set up in Barisal to promote the promising tomato hybrids and seed samples were distributed to farmers. The seeds of these promising hybrids will be provided to the Product Development Support Section of BRAC for further review soon. The most promising ones will be released to farmers in the near future through the variety release system in Bangladesh.

**Source and photos:**
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