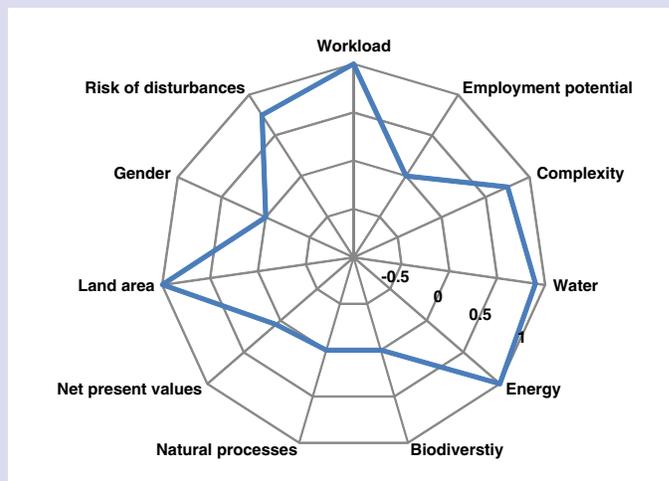


Key facts

- Cheap production of nutritious animal protein.
- A 60 litre container can produce 600 grams of crickets within 60 days.

This graph summarizes the results of a sustainability assessment conducted for this technology. The closer the line is to the outer edge of the diagram, the better the technology performs in terms of the particular criterion.



What are mobile cricket raising units?

- Insects have been a part of the Cambodian and Laotian diets for many centuries. Eating wild fried crickets is very popular and most edible insects are collected in their natural surroundings or around light sources at night in Cambodia's Ratanakiri Province.
- Insects provide a healthy and nutritious dietary alternative to mainstream animal proteins like chicken, pork or fish (FAO, 2013).
- Crickets (*Teleogryllus testaceus* Walker²) can be raised in simple containers like trash bins (Figure 1), with fresh edible insects available every two months, all year round.
- The management of a cricket unit requires a few minutes of time daily, a minimal inception investment (\$3 to \$11) and involves no production cost if the feed is made from agricultural by-products such as dried pounded cassava leaves or rice flour mixtures.
- No veterinary care is necessary.
- Unit size and material can be adapted to farmers' needs (such as concrete jars or tanks). A simple plastic bin of 60 l can produce 600 g of crickets within 60 days.



Figure 1. Cricket farming unit (outside view) with egg packing carton cardboard piece and plate with sponges for drinking (right side), egg bowl (inside the bin), and chicken feed (left side)

¹The details and recommendations described here are based on the experience of the Annadya Project implemented in Ratanakiri Province (Cambodia). They are valid for the situation in Ratanakiri Province, in particular production of crickets mainly for direct household consumption in remote areas with no insect-raising experience. The technology described is seen as an entry point for insect rearing. With more experience, interested farmers can adopt larger units and higher quality feed, if available – as practiced in other countries.

² There are many different types of crickets, e.g. domestic house cricket, common or field cricket, etc. For more information see Hanboonsong *et al.* (2013).

History

This unit has been designed and implemented under the framework of Annâdya, a European Union-funded project promoting appropriate technology for smallholders to increase food security among indigenous peoples and ethnic groups in Cambodia and the Lao People's Democratic Republic (PDR).

Where it works

- Units are meant for small-scale farmers and suitable for uneducated, landless and/or economically vulnerable households.
- Five hundred Cambodian households with limited economic resources, land access and literacy have successfully adopted the technology in Ratanakiri.
- The optimum temperature is between 25°C and 30°C and the unit must be kept in a dry place. During winter, it is recommended to keep the bin inside the house where the temperature is higher. Lower temperatures slow down cricket growth, increasing the number of days until maturity.

Technological aspects

The container

- The box can be a clean plastic trash bin, a cement jar, a wooden box, a tank or a similar container. It must be tightly sealed in order to keep out predators and prevent the crickets from escaping.
- The size of the container can vary: ten crickets can be raised in each litre of container volume (a 60 l container can accommodate 600 crickets).
- One or two openings, usually a major movable opening at the top (for easy access and monitoring) and an optional minor one on the side (for better aeration) with a fine metal mesh stuck on the holes (fixed with staples and/or glue,

silicone or adhesive tape).

- The box must be sheltered from rain and direct sunlight.
- Place objects inside the container to optimize space and allow the crickets to hide and move. Cardboard pieces used in egg-packing cartons are an excellent solution.
- A 'drinking plate' for the crickets is made by placing some water in a saucer in order that the cardboard pieces and the feed do not get damp. A piece of cloth or mosquito net is placed around the drinking plate to facilitate the crickets' access to the water and little sponge pieces or stones are put in the plate so that the baby crickets do not sink.
- The bin stands on a plate with a larger diameter than the bin. Pour some water in the plate, so that the bottom of the bin is submerged in water. The water protects crickets against predators, especially ants. Water should be added approximately twice a week, and every day during the hot season, to ensure there is always enough water in the plate to keep predators from climbing up the bin.

Cricket feed

- The feed must be free of pesticide.
- The feed should ideally be dried. Dry feed facilitates feeding management. However, if fresh feed is used, the leftover must be removed regularly. (N.B. The feed can be dried using Annâdya tunnel solar dryers).
- During the first 20 days, the feed must be cut into small pieces and crushed, milled or pounded.
- The following feed can be used for crickets: commercial chicken feed, a mix of rice (flour/broken rice) and young cassava leaves (ratio approximately 1:1) or young cassava leaves alone (Nieus, 2013). If there is no cassava plant, then cocoyam leaves can be used (if possible mixed with rice flour).



Figure 2. Cricket farming unit (inside view) with some chicken feed inside the egg packing carton cardboard piece (left side), water-filled sponges (right side), egg bowls (top and bottom), and black net to facilitate small crickets' movements

- If available in sufficient quantity, i.e., after satisfying human consumption needs, pumpkin can be used as feed for the last few days before the crickets are harvested. This gives the crickets an attractive 'golden' appearance and better flavour.

Laying eggs and new generation

- When the cricket starts to sing (stridulation), the insect has reached adulthood and is able to reproduce (around 50 days after hatching).
- The egg bowl with substrate to lay eggs can be a wet tissue on a plate, a bowl of wet and burned rice husks (rice husk charcoal) or wet potting soil.
- After one week, the substrate can be removed and put in another box. If more eggs are needed, another egg bowl with substrate can be placed inside. However, crickets with an age difference of more than one week should not be placed together (the older crickets will attack and eat the younger ones). Therefore, at least two boxes should be used when raising crickets with an age difference of more than a week.
- After \pm 10 days, young crickets, similar to adults, will hatch.

Harvest and post-harvest

- A single 60 l production unit can produce 600 g of crickets every 60 days.
- Harvest the crickets, wash them two or three times in clean water and kill them by dipping in hot water before cooking, following the recipe of your choice.
- Cricket faeces can also be harvested and used as fertilizer in vegetable gardens and crop farms.
- Equipment must be cleaned: the box/plate/bowl must be washed with soapy water, rinsed and dried; the husk/soil can be reused after sanitation and the cardboard pieces should be brushed to remove the waste.
- The whole production cycle takes two months. Each unit can operate six production cycles per year.

Where to find crickets

- Free cricket adults are provided to interested farmers from the five districts covered by the Annâdya Project (see contact details below and www.annadya.org).
- Alternatively, egg bowls can be purchased from farmers raising crickets at around \pm \$2.5/unit.
- For cricket collection in the wild: be sure to collect adults from the same species. A sex-ratio with about $\frac{1}{4}$ of males is fine. A female cricket has a long tube at the end of the abdomen to lay eggs under the soil. So, the male will have a "V" type tail while the female will have the "V" with a long tube down the middle.

Economic aspects

- Investment for a 60 l production unit is around \$11 (around \$30 for a 120 l unit). In this case, the investment can be repaid in 10 months (five cycles), and much earlier if some egg bowls are sold (three cycles if two bowls are sold).

Item	Cost (\$)
Trash bin (60 l)	4
Tray	1
Metal mesh and glue or silicone	1.5
Tissue, plate, clothes pin and other small purchases	0.4
Egg packing carton cardboard pieces (for a 60 l bin: \$0.2/unit x 8)	1.6
Cricket eggs (\$2.5/unit x 1)	2.5
Total	11

- Investment can be limited to a few dollars (for buying eggs) if recycled materials are used. If handled with care, the materials can be used for several years. Egg packing carton cardboard pieces should be replaced when damaged; the cardboard pieces are usually completely replaced after 12 to 18 months.
- One production cycle produces an income of \$2.50 if the crickets are sold fresh (\$5/kg). If cooked/fried, the sale income can be two or three times this.
- The production cost is almost none if the unit uses agricultural by-products (around \$0.2 per cycle for buying low-grade rice for a feed of rice and cassava leaves).

Environmental aspects

- Cricket farming in a 60 l unit uses around 4 l (0,004 m³) of water per production cycle and 24 l per year (mainly water around the base of the bin to protect crickets from predators).
- No energy is required.
- All (100 per cent) of the feed can be on-farm sourced.

Social aspects

- One production cycle of 50 days needs around 2.5 hours of work:
 - Time to water and feed: \pm 2 minutes x 50 days = \pm 100 minutes.
 - Time to harvest, clean and start a new generation of crickets = 45 minutes.
- One person is sufficient to operate a small unit (management time estimated at 15 minutes per week). In case of three or four very large units (like tanks), there can be a full-time employee.

- Men usually construct the units which are mainly managed by women who feed the insects.
- The unit does not need much space: the facility (with the 60 l bin) has a diameter of 50 cm and a height of 50 cm. Large units are also not cumbersome, being usually 5 m long, 2 m wide and 1 m high.

Issues for replication

- Climatic considerations: high humidity promotes the outbreak of disease and low temperatures (< 20°C) slow down cricket growth. It is, therefore, important not to spill any water inside and/or to bump the unit as this could spill the drinking water.
- In choosing the location for the cricket bins, it should be considered that the singing of adult male crickets can be noisy.
- Non-toxic leaves should be available all year round to feed the crickets.

Experts and contacts

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