**Trap crops as a Biocontrol Agent**

**What are trap crops?**

Crops which are planted along with the main cash crop to protect it from a specific pest or several pests. They work by attracting the pests for feeding, breeding and survival thereby preventing the insect from reaching the crop. They concentrate the pest in specific areas of the field where insect management practices like insecticide spraying can be used to destroy them. Trap crops are generally planted at a specific time in the pest's life-cycle, and then destroyed before that life-cycle finishes. The trap crop can be from same family or a different family. These crops are generally planted in alternating rows along the main crop as strips in between (row intercropping) or as border (perimeter trap cropping) all around the main crop.

**Why is trap cropping gaining importance?**

Prior to the introduction of modern synthetic insecticides, trap cropping was a common method of pest control. The recent resurgence of interest in trap cropping as an IPM tool is the result of concerns about potential negative effects of pesticides on human health and the environment, pesticide resistance, and general economic considerations of agricultural production

**What are the required characteristics of crop plants?**

Inherent characteristics of a trap crop may include not only natural differential attractiveness for oviposition and feeding, but also other attributes that enable the trap crop plants to serve as a sink for insects or the pathogens they vector.

**What factors affect the effectiveness of trap cropping?**

Successful use of trap crops within a field depends on the inherent characteristics of the trap crop and the higher value crop, the spatial and temporal characteristics of each, the behavior and movement patterns of insect pests, and the agronomic and economic requirements of the production system.

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**Examples:**

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| Trap crop | Main crop | Method of planting | Pest controlled |
| Alfalfa (Meyer, 2003) | Cotton | Strip intercrop | Lygus bug |
| Basil and marigold (MMSU, 2003) | Garlic | Border crops | Thrips |
| Castor plant (Hasse, 1986; 1987) | Cotton | Border crop | Heliotis sp. |
| Chervil (Ellis; Bradley, 1996) | Vegetables Ornamentals | Among plants | Slugs |
| Chinese cabbage, mustard, and radish (Facknath, 1997; Muniappan; Lali, 1997) | Cabbage | Planted in every 15 rows of cabbage | Cabbage webworm Flea hopper Mustard aphid |
| Beans and other legumes | Corn | Row intercrop | Leafhopper Leaf beetles Stalk borer Fall armyworm |
| Chick pea (Grundy; Short, 2003) | Cotton | Block trap crop at 20 plants/ sq m (Brown, 2002) | Heliotis sp. |
| Collards (Boucher; Durgy, 2003) | Cabbage | Border crop | Diamondback moth |
| Corn (Hasse, 1986; 1987) | Cotton | Row intercrop, planted in every 20 rows of cotton or every 10-15 m | Heliotis sp. |
| Cowpea (CIKS, 2000) | Cotton | Row intercrop in every 5 rows of cotton | Heliotis sp. |
| Desmodium (ICIPE, 2003) | Corn Cowpea Millet Sorghum | Row intercrop | Stemborer Striga |
| Dill and lovage (Ellis; Bradley, 1996) | Tomato | Row intercrop | Tomato hornworm |
| Green beans (Ellis; Bradley, 1996) | Soybean | Row intercrop | Mexican bean beetle |
| Horse radish (DA, Philippines, 1997) | Potato | Intercrop | Colorado potato beetle |
| Hot cherry pepper (Boucher; Durgy, 2003) | Bell pepper | Border crop | Pepper maggot |
| Indian mustard (Cornell University, 1995) | Cabbage | Strip intercrop in between cabbage plots | Cabbage head caterpillar |
| Marigold (French and African marigold) (Vann; Kirkpatrick; Cartwright, 2004) (Dofour; Guerena; Earles, 2003) | Solanaceous Crucifers Legumes Cucurbits | Row/strip intercrop | Nematodes |
| Medic, Medicago litoralis (Miles, C.; et al., 1996) | Carrot | Strip intercrop in between carrot plots | Carrot root fly |
| Napier grass (ICIPE, 2003) | Corn | Intercrop Border crop | Stemborer |
| Nasturtium (Ellis; Bradley, 1996) | Cabbage | Row intercrop | Aphids Flea beetle Cucumber beetle Squash vine borer |
| Okra (Hasse, 1986; 1987) | Cotton | Border crop | Flower cotton weevil |
| Onion and garlic | Carrot | Border crops or barrier crops in between plots | Carrot root fly Thrips |
| Radish (Ellis; Bradley, 1996) | Cabbage family | Row intercrop | Flea beetle Root maggot |
| Rye (OIKOS, 2003) | Soybean | Row intercrop | Corn seedling maggot |
| Sesbania (Naito, 2001) | Soybean | Row intercrop at a distance of 15 m apart | Stink bug |
| Sickle pod (OIKOS, 2003) | Soybean | Strip intercrop | Velvet bean caterpillar Green stink bug |
| Soybean | Corn | Row intercrop | Heliotis sp. |
| Sudan grass (ICIPE, 2003) | Corn | Intercrop Border crop | Stemborer |
| Sunflower (CIKS, 2000) | Cotton | Row intercrop in every 5 rows of cotton | Heliotis sp. |
| Tansy (DA, Philippines, 1997) | Potato | Intercrop | Colorado potato beetle |
| Tobacco (Hasse, 1986; 1987) | Cotton | Row intercrop, planted in every 20 rows of cotton | Heliotis sp. |
| Tomato (Makumbi, 1996) | Cabbage | Intercrop (Tomato is planted 2 weeks ahead at the plots' borders) | Diamondback moth |
| Vertiver grass (van de Berg, Undated) | Corn | Perimeter crop | Corn stalk borer |

**How many types of trap cropping methods are used?**

1. **based on the Trap Crop Plant Characteristics**

* **Conventional trap cropping**: it is the most general practice of trap cropping, in which a trap crop planted next to a higher value crop is naturally more attractive to a pest as either a food source or oviposition site than is the main crop, thus preventing or making less likely the arrival of the pest to the main crop and/or concentrating it in the trap crop where it can be economically destroyed. Eg. Use of alfalfa as a trap crop for lygus bugs in cotton.
* **Dead-end trap cropping:** The trap crops used are highly attractive to insects but on which the insects or their offspring cannot survive. Dead-end trap crops serve as a sink for pests, preventing their movement from the trap crop to the main crop later in the season. Eg. *Crotalaria juncea*, has also been suggested as a dead-end trap crop for the bean pod borer, *Maruca testulalis*.
* **Genetically engineered trap cropping:** Crop is genetically modified to include trap crop characteristics. Hence it is made to order trap crop. Example, Bt-potatoes that express proteins from *Bacillus thuringiensis* (Bt) trap Colorado potato beetle (*Leptinotarsa decemlineata*). *Brassica oleracea var. acephala*, transformant expresses the Cry1Ac protein from Bt. Genetically engineered trap crops are also used in controlling insect-vectored pathogens such as virus. For instance, when a virus-laden insect probes a noninfected transgenic plant, the virus is rapidly removed from the aphid’s stylet. This type of trap crop also fits within the definition of barrier crops, which can be an effective crop management strategy. The use of genetically engineered plants, offers additional possibilities because the same plant species can be used as a barrier crop and the protected crop.

1. **Based on mode of use of Trap Crop**

* **Perimeter trap cropping**: Trap crop is planted around the border of the main crop. The pest is concentrated in the outer rows, where it can be treated with insecticides, cultural practices etc.
* **Sequential trap cropping:** This method involves planting of trap crops earlier and/or later than the main crop.
* **Multiple trap cropping:** This involves planting several plant species simultaneously as trap crops with the purpose of either managing several insect pests at the same time or enhancing the control of one insect pest by combining plants whose growth stages enhance attractiveness to the pest at different times.
* **Push-pull trap cropping:** or “stimulo-deterrent diversion” strategy is based on a combination of a trap crop (pull component) with a repellent intercrop (push component). The trap crop attracts the insect pest and, combined with the repellent intercrop, diverts the insect pest away from the main crop.

#### What are the advantages of trap cropping?

* Reduces the use of pesticide
* Lowers the pesticide cost
* Preserves the indigenous natural enemies
* Improves the crop's quality
* Helps conserve the soil and the environment

**What are the limitations of trap cropping?**

* Crops are attacked by a complex of insect pests and because trap crops tend to be relatively species specific makes them less practical compared with other alternative IPM strategies, e.g., the use of broad-spectrum insecticides.
* Cost of insecticide control is often low compared with the cost of setting aside land for trap cropping, especially in the case of vegetables and other high-value crops.
* Agronomic and logistical considerations associated with implementing trap crops, such as different planting dates and fertilizer requirements of the trap crop and main crop, are also limit the practical use of trap cropping.
* Success of some trap cropping systems has been highly variable, increasing the risk of economic loss to the grower.
* Trap cropping is also knowledge-intensive and demands information on the temporal and spatial attractiveness of potential trap crops to maximize their effectiveness.
* Trap cropping may even require cooperation between farmers because pests move freely between adjacent farms.
* Trap crops may inadvertently put the main crop at risk if they harbor certain insects and pathogens that could be harmful to the main crop.