

Pest management

through trap and border crops in vegetables

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Ecological management of pests is a sustainable practical approach to achieve food security while protecting environment. The primary objective of Integrated Pest Management (IPM) is reducing input cost for pesticides and save ecosystem from harmful effect of pesticide residues. Many strategies like use of sticky and pheromone traps, early and delayed planting etc. are common recommendations while trap crop and border crop are unique with respect to managing enemies i.e. diverting crop enemies causing economic losses and enhancing natural enemies which are beneficial from ecosystem point of view with additional advantage of economic benefit from secondary crop. Therefore, trap and border crop are efficient, environment friendly and sustainable approach to manage insect-pests for commercial cultivation of vegetable crops.

Keywords: Border crop, Pest management, Trap crop, Vegetable

PEST management practices usually involve indiscriminate usage of harmful pesticides which leads to development of insecticide resistance and non-targeted effect on natural enemies and environment. Major insect-pests in different parts of the country is reported to be 33 to 40%. Therefore, for sustainable ecosystem of crop production, IPM (Integrated pest management) is recommended. Trap cropping and border cropping are one of the alternative pest management techniques that can be easily adopted by farmers for vegetable cultivation.

Trap and Border crop

Trap crops are those crop species planted with main crop as intercropping or in border rows with the specific purpose of attracting insects or pests for feeding, breeding (oviposition) and survival thereby avoiding damage to the main crop by completing their life cycle on trap crop species. However, trap crop must be compatible to the main crop and non-competitive for fertilizer

inputs. Trap crop can also be used as a live nursery for beneficial predator species as it congregates pest population in limited area. Hence, control of pests by spraying on only trap crop make easy to manage invading pests of main crop.

Border crop are other crop species than primary crop sown in perimeter with the purpose of management of pests, providing isolation in seed production system, avoiding viral diseases and sun stroke during summer season in main crop. Apart from these objectives, border crop also helps to conserve soil and moisture in ecosystem. These crops should be selected based on their inflorescence system, plant height to act as physical barrier and adaptability to the region. Border crop are sown one month prior of the main crop in single row or double row system and provide extra remuneration to the farmers from economic yield and fodder for animals from vegetative parts.

Advantages of trap and border crop

Although trap and border crop are

have different criteria for selection with main crop, but biotic stress (pests/ diseases) management is common objective in both the cases. Hence, use of trap and border crops reduces pesticide application in main crop and subsequently lowers the pesticide cost. Low pesticide application improves crop's quality for consumption. Natural enemies attracted to these crops are leaving very impressive effect for ecosystem and environment. Also, they conserve soil moisture and pay extra to the farmers other than main crop from economic produce of trap or border crop.

Examples of trap and border crop

Trap crop: Trap crop planting should be done 25-30 days ahead of the main crop to attract insects through mimic flowering morphology, attractive flower colours, plant volatiles etc. Some trap crop examples are mentioned in Table 1.

Border crop: Border crop are also known as barrier crop. Ideally border crop should be attractive to

Table 1. List of important trap crops and attracted insects

Main crop	Trap crop	Insect-pests attracted by trap crop
Cucurbits	Summer squash	Pickleworm (<i>Diaphania nitidalis</i>)
Tomato, beans	Summer squash	Whitefly (<i>Bemisia argentifolii</i>)
Cabbage, Cauliflower	Indian mustard	Diamond Back Moth (<i>Plutella xylostella</i> L.)
Tomato	African marigold, Calendula	Tomato fruit borer (<i>Helicoverpa armigera</i> L.)
White cabbage	Chinese cabbage	Flea beetle (<i>Phyllotreta cruciferae</i>)
Bell pepper	Sunflower, Sorghum	Stink bug (<i>Halyomorpha halys</i>)
Common bean	Eggplant	Silverleaf whitefly (<i>Bemisia argentifolii</i>)
Onion	Carrot, Buckwheat	Thrips (<i>Thrips tabaci</i>)
Muskmelon	Buttercup squash	Striped cucumber beetle (<i>Acalymma vittatum</i>)
Lettuce	Alfalfa	European tarnished plant bug (<i>Lygus rugulipennis</i>)
Okra	Short duration Pigeon pea	Fruit worm (<i>Helicoverpa armigera</i> L.)
Cabbage, Cauliflower	Radish	Cabbage borer (<i>Hellula undalis</i>)

the natural enemies and non-host to the vectors but appealing for landing and probing before take-off. Border crops may act as a “sink” for viruses invading new crops. Some major virus carrying vectors like aphids loose virus stylet once landing on maize silk and therefore main crop remains protected from virus infection. Border crop has effective impact in management of pests which ultimately leads to least incidence of diseases like okra yellow vein mosaic virus, leaf curl virus in chilli, pepper veinal mottle virus etc. Sowing of border crop should be done in very close spacing or dense. It could be either single row crop (maize, arhar, sorghum) or double row crop (maize and arhar). Sweet corn can be also a suitable crop in replacement of maize to earn remunerative price from produce. Some most common examples of border crop practised in vegetable

cultivation are:

- Maize as a border crop with cauliflower
- Sorghum as a border crop with cauliflower
- Pigeon pea as a border crop with okra and chilli
- Maize as a border crop with watermelon

Seed production with border crop: Seed productions of cross pollinated vegetable crops require isolation distance upto one kilometer and even more which is usually difficult to maintain by breeders or farmers in field. Border crop is having potential to be utilized as mechanism of providing space isolation for seed production. In general, 5-7% area of main crop allocated for border crop to take advantage of IPM module and additional economic benefit from border crop.

Economics of seed production

alongwith border crop: Economic analysis revealed that seed production of amaranth is more profitable with border crop of sweet corn in terms of pest management, gross return, net return and benefit cost ratio (Table 2). The gross returns of ₹4,35,000 /ha was recorded from amaranth seed (main crop) and sweet corn in border rows due to higher values of economic yield. Additionally, no spray for pest management was needed during the entire seed production of amaranth, which encourages same IPM module in seed production of other vegetable crops also.

Limitations of trap and border crop

- Application of trap crop and border crop is not an ultimate solution to all insect-pest problems because it needs additional pest management strategies based on insect

Table 2. Economics of amaranth seed production with sweet corn as border crop

Expenditure	Per unit rate	Total cost (₹/ha)
Land preparation	₹50,000 per acre	1,25,000
Labour wages for intercultural operations and seed processing (threshing, cleaning etc.)	Labour wages @ ₹350 per person	25,000
Miscellaneous (input seed cost, irrigation, weedicide etc.)	-	8,000
Total expenditure		1,58,000
Income from Amaranth seed produced (1tonnes/ha)	TL seed price of amaranth @ ₹400/Kg	4,00,000
Income from sweet corn produced	Market price of sweet corn @ ₹30/ kg	35,000
Gross income		4,35,000
Net income (B-A)		2,77,000
Benefit-cost ratio		1:2.75



Seed production of amaranths with sweet corn as border crop

- Timely sowing and removal is very important for border and trap crop and any avoidance will lead to failure of purpose.

SUMMARY

It is important to adopt border and trap crop strategies as a component of IPM module for multifarious advantage with high yield of vegetable crops. Seed production with border crop provides opportunity of additional income generation with sustainable ecosystem and resource conservation. However, it is equally important to consider other approaches for complete protection from invaded pests in cultivated vegetable crop. Most common crops may be used for trap or border crops for commercial cultivation of vegetable crops and judiciously may be applied to other crops also.

- behaviour.
- Pests accumulated on trap or border crop should be destroyed with suitable strategies like cultural method or natural

- enemies before their spillage to main crop.
- Results of trap and border crop may vary according to weather conditions.

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