Trap Crops, Intercropping and Companion Planting

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Benefits of trap crops and intercropping:

- Reduce damage to cash crops
- Attract beneficial organisms
- Decrease the use of external inputs (e.g., insecticides, herbicides, fungicides)
- Enhance biodiversity
- Increase productivity

Trap Crops

Trap crops are grown as a control measure to lure pests away from the cash crop to protect it from attack. Pests are either prevented from reaching the crop or concentrated in certain parts of the field away from the main crop. The principle of trap cropping relies on pest preference for certain plant species, cultivars or a certain stage of crop development. Plants produce chemicals, or volatiles, that attract insects for pollination and repel pest insects. Different species and cultivars produce varying degrees of unique volatiles, allowing certain species or varieties to repel insect pests more strongly than others, making them suitable for selection as a trap crop. The two primary techniques utilized in trap cropping are: 1) selection of a more preferred plant species or cultivar grown at the same time as the main crop; 2) planting of the same species and cultivar as the main crop timed to be at the most preferred stage of development before the main crop. Whether using the same or different species, it is essential that the trap crop be more attractive than the main crop.

Trap cropping offers several benefits in a pest management system. When trap crops successfully attract pest populations, damage to the main crops

is limited; therefore, main crops seldom require treatment with insecticides. When insect pests are at high concentrations in trap crops, they can be treated in a localized area instead of treating the entire field. Savings resulting from reduced pest attack and insecticide use may substantially outweigh the cost of maintaining crops that do not provide economic income. Reduced damage to main crops also increases their expected marketable yield. Further, a variety of plantings and increased concentration of insect pests may attract natural enemies, enhancing naturally occurring biocontrol.

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The design and arrangement of trap and main crops depends largely upon the target pest. Knowledge of target insect behavior is therefore necessary when creating a field design. For example, a perimeter trap crop may be sufficient for reducing damage of the main crop by Colorado potato beetle, but intermittent plantings may be required for more mobile species such as the striped cucumber beetle. Trap crops may also be designed for nematodes and fungi that cause plant diseases. The required size of the trap crop is a function of the number of pests expected and the mobility of the species, but the proportion of the trap crop is typically 10-20 percent of the main crop. The primary key for effective trap cropping is the successful establishment and management of the trap crop stand; more desirable plants within the trap crop stand will have a greater impact on luring pests away from the main crop. For enhanced control, the use of trap crops can be combined with other pest management strategies, such as crop rotations, to reduce the number of expected pests, and pheromone traps, to attract pests to desired areas away from the main crop.

Despite the benefits of using trap crops, there are several concerns. First, trap cropping is only beneficial when fields are likely to be invaded with high numbers of pests. Improper management of pests on trap crops may create "pest nurseries," facilitating a more rapid or widespread pest outbreak than may otherwise have occurred. Treatment of trap crops with insecticide may lead to increased evolution of pesticide resistance and destruction of natural enemies. Further complications may arise when trying to manage multiple pests with different behaviors. Application may be limited for certain crops.

Intercropping

Intercropping is the growing of two or more crops in close proximity to promote beneficial interactions between them. The principle of trap cropping relies on combining plants in such a way that they occupy different ecological niches. Plants that occupy different niches are more likely to complement each other as they use different resources and carry out different functions.

When designing an intercropping scheme, there are four components to consider: spatial arrangement, plant density, maturity date and plant architecture. Intercropping may be used in several spatial arrangements:

→ *Row intercropping* refers to two or more crops grown together at the same time with at least one crop planted in rows.
→ S*trip intercropping* refers to growing two or more crops together in strips wide enough to permit separate crop production using machines but close enough for the crops to interact.
→ *Mixed intercropping* has no distinct row or strip arrangements.
→ *Relay intercropping* is used for planting in succession, where a second crop is planted into a standing crop at the reproductive stage before harvesting.

Seeding rates are often reduced to avoid overcrowding. Rates should also reflect the desired yield for each crop. Staggering planting / harvesting dates takes advantage of peak resource demands, reducing competition between crops. Including plants with a variety of heights and growth patterns also ensures reduced competition. For example, a tall corn plant can capture sunlight and create a beneficial understory environment for a low-growing, shade-tolerant species.

The use of intercropping can provide benefits to a management system, including decreased insect pest pressure, reduced need for external inputs, increases in biodiversity, enhanced production and lower economic risk. Separating susceptible plants with non-host species provides a physical barrier to insect pest movement, limiting spread and decreasing likelihood of damage to susceptible varieties. For example, separating plantings of solanaceous crops, such as tomatoes and potatoes, that are susceptible to

Colorado potato beetle, with a non-host crop, such as corn, can reduce the movement of Colorado potato beetles from one solanaceous crop to another. The addition of multiple species enhances biodiversity and encourages beneficial insect populations, offering natural biocontrol. Resulting beneficial interactions between plants can confuse insects, lowering insect pest levels, lessening the extent of damage and reducing the need for external inputs. Inclusion of multiple crops utilizing different environmental niches increases the productivity per unit of land, allowing for financial diversification, as well as a reduced financial risk in the event of crop failure.

Companion Planting

Companion planting refers to the establishment of two or more species in close proximity so that some cultural benefit, such as pest control or increased yield, may be achieved. Companion planting is a method of mixed intercropping most often used in small gardens; other methods of intercropping, such as row or strip intercropping, are intended for agricultural production at a larger scale, allowing for use of machinery. Interactions between plants can take several forms; they may be either beneficial or detrimental. Growing basil and tomatoes together may improve the health, flavor or yield of tomatoes. Plants that exhibit allelopathy interfere with neighboring plants (allelopathy refers to release of chemicals by one plant that inhibit the growth of another plant). For example, using ryegrasses as a mulch can suppress weeds, but may also suppress the growth of neighboring plants. Plants may also

interact with other organisms. Some plants repel pests; for example, onions and leeks grown alongside carrots can act as a repellant to the carrot fly. Other plants attract beneficial insects that help manage pest populations or enhance pollination; flowers and perennial plants may provide habitat and food sources to predatory beetles and attract bees and butterflies.

For more resources on trap crops, intercropping and companion planting, visit http://organics.utk.edu/growers.htm#Companion.

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