Virginia Cooperative Extension
Virginia Tech • Virginia State University

EXPERT REVIEWED

SPES-620P

Companion Planting in Gardening

Authored by Leonard Githinji, Professor, Virginia Cooperative Extension, Virginia State University

Introduction

Companion planting is the art of growing two or more compatible plants in close proximity to attract beneficial insects, repel pests, and generally improve the growth of some or all of the plants involved. This is best exemplified by the practice adopted by Native American communities hundreds of years ago, involving three plants — corn, pole beans, and squash, popularly known as the "Three Sisters."

When planted together, the Three Sisters help one another thrive and survive. Among them, corn is referred to as "the supportive sister," as it provides support to the bean plant that has a climbing habit. The bean plant itself is referred to as "the giving sister" due to its ability as a legume to fix nitrogen, which is helpful to all three plants. The last member, squash, is referred to as "the protective sister" due to its ability to cover the soil and prevent soil moisture loss. In addition, the squash produces prickly vines that can keep pests such as rabbits away (fig. 1).

Although the three-sister companion planting demonstrates the benefits of mainly intercropping in a physical sense (support and protection), other pairings provide intangible advantages such as the production of chemicals that stimulate the growth of the companion or that repel insect pests, among other benefits. Examples of such companions include pepper and zinnia; dill and pepper; kale and zinnia; and eggplant and celery (fig. 2). Although the three-sister companion planting demonstrates the benefits of mainly intercropping in a physical sense (support and protection), other pairings provide intangible advantages such as the production of chemicals that stimulate the growth of the companion or repel insect pests, among other benefits. Examples of such companions include pepper and basil, kale and zinnia, and marigold and tomato (Fig. 2).

Figure 1. Companion planting including corn, bean, and squash at the Virginia State University Urban Agriculture Demonstration Site.

2A 2B 2C

Figure 2. Companions between pepper, basil, and zinnia (a); kale and zinnia (b); and marigold, zinnia and tomato (c).

Benefits of Companion Planting

Companion planting is used by farmers and gardeners in both industrialized and developing countries for many reasons. These include pest management, nitrogen fixation, providing support of one plant by another, enhancing nutrient uptake, and water conservation, to name a few. Companion planting can lead to increased crop productivity as well as an enhancement of biodiversity.

Many of the modern principles of companion planting were present many centuries ago in the cottage garden. Companion planting is considered a form of polyculture, defined as growing multiple crops in the same space at the same time. This farming practice is basically an attempt to imitate the diversity of natural ecosystems by avoiding large stands of single crops (monoculture).

There are many scientific bases for the advantages of companion planting, which include practices like trap cropping, symbiotic nitrogen fixation, biochemical pest suppression, physical/spatial interactions, nurse cropping, offering beneficial habitats, and providing economic or financial security through biodiversity. Each of these is addressed below.

Trap Cropping

Insects, just like many animals, have a scale of preference when it comes to food. Although some insects feed on only one food material or host, others, given a choice, will gravitate towards their preferred food. Of course, if that food is not available, they will feed on less preferred food materials within their host range. Trap cropping involves growing plants that attract insect pests the most to distract them from the main crop. An excellent example of this is the use of collards to draw the diamondback moth pest away from cabbage. Another example is Blue Hubbard squash that attracts squash bugs, squash vine borer, as well as spotted and striped cucumber beetles. The main idea in trap cropping is to offer a plant that is more attractive to the insect pest than the main crop. This can be a plant that is entirely different from the main crop, a more appealing variety of the same crop, or the same variety of the crop planted at a time that makes it more desirable than the main crop. Trap crops are usually planted about a couple of weeks earlier to give them a head start over the main crop. The height and density of trap crops are carefully selected to provide a barrier that protects the main crop. With trap cropping, the insects congregated on trap crop plants can be more easily controlled with insecticides or other non-pesticide control methods. Because trap crops are sacrificial crops not meant for consumption, pesticides can be applied to them at higher-than-normal concentrations to manage insect pests to prevent migration to the main crop. On farms and in large gardens, the much smaller area occupied by trap crops (relative to the main crop) means that pesticide applications are less than what would have been required to spray the entire main crop. Depending on the spatial arrangement of the trap and main crops, the pairing modifies the behavior of targeted insect pests for the benefit of gardeners and farmers.

Symbiotic Nitrogen Fixation

Nitrogen fixation refers to the conversion of atmospheric nitrogen (N_2) to ammonium ion (NH_4^+) and then to nitrogen-containing organic compounds that are available for plant use. Symbiotic nitrogen fixation is accomplished with the help of microorganisms such as rhizobium bacteria that are harbored in the root nodules of legumes. Peas, beans, and clover are examples of leguminous plants that can fix nitrogen. Although most of the fixed nitrogen is used by the host plant, some may be excreted from the nodules into the soil and used by nearby plants. Therefore, including a legume in companion planting can be of tremendous benefit to nearby plants, especially where the soil is naturally low in organic matter and hence low in nitrogen.

Biochemical Pest Suppression

Some plants exude chemicals from roots or aerial parts that suppress or repel pests and protect neighboring plants. Marigolds (*Tagetes spp.*), for example, release thiopene — a nematode repellent — making it a good companion for many garden plants. The mechanisms by which some plants manufacture and release certain biochemicals that either enhance or suppress other plants are referred to as *allelopathy*. The biochemicals released through such mechanisms are referred to as *allelochemicals*. An example of this is the release of juglone by black walnut, which suppresses the growth of a wide range of other plants. While this may be a problem in home horticulture, there is a positive application of allelopathy, such as the use of mow-killed cereal rye (*Secale cereale* L.) as a mulch. Thus, rye can be planted as a cover crop in the fall and terminated in the following spring by mowing. The allelochemicals that leach from rye residue can prevent weed seed germination but do not harm transplanted tomatoes, broccoli, or many other transplanted vegetables.

Spatial Interactions

Spatial interaction of plants can be applied in companion planting with multiple benefits. For example, tall-growing, sun-loving plants may share space with lower-growing, shade-tolerant species, resulting in higher total yields from the land and sometimes aiding in pest control. For example, a diverse canopy results when corn is companion-planted with squash or pumpkins, which is believed to disorient the adult squash vine borer and protect the vining crop from this damaging pest. In turn, the presence of the prickly vines tends to discourage raccoons from ravaging the sweet corn.

Nurse Cropping

Nurse cropping involves planting specific plants to provide one type of protection or another for young crops as they become established. For example, tall or dense-canopied plants may protect more vulnerable species through shading or by providing a windbreak. Nurse crops such as oats have long been used to help establish alfalfa and other forages by supplanting the more competitive weeds that would otherwise grow in their place. In many instances, nurse cropping is simply another form of physical/spatial interaction. Thus, the benefits of nurse cropping include reducing weeds, preventing wind damage, and protecting the soil from erosion. Additionally, perennial seedlings are protected from excessive sun in their first weeks of growth, when they are most vulnerable to heat and water stress.

Beneficial Habitats

Beneficial habitats are another type of companion plant interaction that has drawn considerable attention in recent years. The benefit is derived when companion plants provide a desirable environment for beneficial insects and other arthropods — especially those predatory and parasitic species that help keep pest populations in check. Predators include ladybird beetles, lacewings, hover flies, mantids, robber flies, and non-insects such as spiders and predatory mites. Parasites include a wide range of fly and wasp species, including tachinid flies, and Trichogrammatid and ichneumonid wasps. The intentional inclusion of plants to serve this purpose is called "farm scaping." Agroecologists believe that developing systems to incorporate habitats that attract and sustain beneficial insects can help growers achieve the dual objectives of reducing both pest damage and pesticide use. For instance, encouraging a higher population of parasitic wasps can lower caterpillar pest damage, though parasitism, or the presence of ladybugs, can reduce aphid infestation through predation. Flowers provide nectar and pollen for adult parasitic wasps, thus establishing a variety of flowering plants that bloom at different times of the year ensures a continuous supply of food for these beneficial insects. Pollen-rich herbs like dill and cilantro can attract beneficial ladybugs.

Security through Diversity

Plant diversification, particularly through intercropping, can lead to a more stable plant ecosystem. In a monoculture, the high level of genetic uniformity that characterizes the cultivation of one variety of a crop creates a very favorable environment for pests, which puts all the plants at risk. A more general mixing of various crops and varieties provides a degree of security to the grower. If pests or adverse conditions reduce or destroy a single crop or cultivar, others remain to produce some level of yield. Thus, the planting of multiple crops in the same space at the same time is an attempt to imitate natural plant diversity.

Table 1 below lists examples of companion plants for home and market gardening. It also provides information on plants that should be avoided as companions. For instance, tomato and potato should not be planted together as companions, as they are attacked by the same pests and diseases.

Table 1. Companion Planting Chart for Home and Market Gardening

CROP	COMPANIONS	INCOMPATIBLE
Asparagus	Tomato, Parsley, Basil	Onion, Garlic, Potato
Beans	Carrot, Cabbage, Cauliflower, Cucumber	Leek, Garlic
Beans, Bush	Irish Potato, Cucumber, Corn, Strawberry, Celery, Summer Savory	Onion
Beans, Pole	Corn, Summer Savory, Radish	Onion, Beets, Kohlrabi, Sunflower
Cabbage Family	Aromatic Herbs, Celery, Beets, Onion Family, Chamomile, Spinach, Chard	Dill, Strawberries, Pole Beans, Tomato
Carrots	English Pea, Lettuce, Onion Family, Tomato	Dill, Parsnip, Radish
Celery	Onion and Cabbage Families, Tomato, Bush Beans, Nasturtium	Parsnip, Potato
Corn	Irish Potato, Beans, English Pea, Pumpkin, Cucumber, Squash	Tomato
Cucumber	Beans, Corn, English Pea, Sunflowers, Radish	Irish Potato, Aromatic Herbs
Eggplant	Beans, Marigold	
Lettuce	Carrot, Radish, Strawberry, Cucumber	Garlic, Onion, Leeks, Chives
Onion Family	Beets, Carrot, Lettuce, Cabbage Family, Summer Savory	Beans, English Peas
Parsley	Tomato, Asparagus	Mint, Carrot, Lettuce
Pea, English	Carrots, Radish, Turnip, Cucumber, Corn, Beans	Onion Family, Gladiolus, Irish Potato
Potato, Irish	Beans, Corn, Cabbage Family, Marigolds, Horseradish	Pumpkin, Squash, Tomato, Cucumber, Sunflower
Pumpkins	Corn, Marigold	Irish Potato
Radish	English Pea, Nasturtium, Lettuce, Cucumber	Hyssop
Spinach	Strawberry, Bush Bean	Cauliflower, Cabbages, Broccoli
Squash	Nasturtium, Corn, Marigold	Irish Potato
Tomato	Onion Family, Nasturtium, Marigold, Asparagus, Carrot, Parsley, Cucumber	Irish Potato, Fennel, Cabbage Family
Turnip	English Pea	Irish Potato

Additional Resources

Cornell University Cooperative Extension. 2008. "Nitrogen Fixation." Agronomy Fact Sheet Series. Fact Sheet 39. http://nmsp.cals.cornell.edu/publications/factsheets/factsheet39.pdf.

Kuepper, G., and M. Dodson. 2001. "Companion Planting: Basic Concept and Resources." ATTRA (Appropriate Transfer Technology for Rural Areas), National Center for Appropriate Technology. http://www.theunitygardens.org/uploads/1/4/5/0/14506314/companion_planting_handout.pdf.

No Dig Vegetable Gardens. n.d. "Companion Planting: Vegetable Gardening Plant Combinations." Companion Planting. Vegetable Gardening Plant Companions and Combining (Accessed, August 29, 2025)

Pinero, J. 2017. "Trap Cropping: A Simple, Effective, and Affordable Integrated Pest Management Strategy to Control Squash Bugs and Squash Vine Borers." Integrated Pest Management, University of Missouri. https://ipm.missouri.edu/MEG/2017/3/Trap_cropping/.

Visit our website: www.ext.vt.edu

Produced by Virginia Cooperative Extension, Virginia Tech

VT/1125/SPES-620P