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Companion Planting

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Most people think of plants as very passive organisms. They grow almost unperceptively, and only once a year do they flower or produce edible products. However, plants are very active in ways that are not so obvious to the casual observer. For example, plants change the chemistry of the soil, and influence the types of microorganisms that grow there. They actively compete with other plants for space. Some will poison their neighbor's offspring to maintain a competitive advantage, while others change the environment in ways that benefit other species. Plants wage a constant battle with insects, relying heavily on chemical warfare.

Naturalists have known about these properties of plants for thousands of years. For example, about 2,000 years ago the Roman agriculturalist, Varro, declared "Large walnut trees close by, make the border of the farm sterile." Chemicals in oak leaves retard the development of insects that feed on them. Some insecticides are derived from plants; examples include rotenone, sabadilla and ryania. But not all effects of plants are deleterious on other organisms. Alfalfa and clover enrich the soil with nitrogen that they capture from the air. Certain trees move groundwater to the soil surface where shallow-rooted plants can grow even under droughty conditions. Groups of plants which grow well together are called "companions."

Perhaps the best historical example of companion planting is the "Three Sisters" in which corn, beans, and squash are planted together in a hill. Native Americans developed this system to provide food for a balanced diet from a single plot of land. Each of the crops is compatible with the others in some way. The tall corn stalks provide a support structure for the climbing beans. The beans do not compete strongly with the corn for nutrients since as legumes, they can supply their own nitrogen. Squash provides a dense ground cover that shades out many weeds which otherwise would compete with the corn and beans.

Modern agriculture tends to rely heavily upon specialized machinery and synthetic inputs, and have rendered companion systems such as the "Three Sisters" obsolete. Obviously, it would be difficult to harvest corn, beans and squash simultaneously with a machine, especially when they are not planted separately in rows. However, interest is growing in using these special properties of plants to our advantage when growing food. Home gardeners, unencumbered by the need for specialized equipment or row crop production, have rediscovered some of the beneficial interrelationships among plants. This knowledge, coupled with a long tradition of folklore, is being utilized to improve home garden production.

How can you use these special plant properties?

Selecting a cover crop

Certain cover crops concentrate specific nutrients in their tissues. Deeply rooted plants move nutrients from the subsoil to the aboveground parts, and when the plants decompose, the nutrients become available for subsequent crops. Potassium levels can be increased significantly by selecting a good preplant cover crop. Buckwheat, grain rye, and sudangrass are good preplant covers.

Plants in the legume family are capable of gathering unusable nitrogen from the air and converting it into usable nitrogen in root nodules, with the help of special bacteria. Legumes increase soil fertility as they decompose, thus releasing the stored nitrogen. An alfalfa sod that is plowed under will provide 150 to 200 lbs of nitrogen per acre the following year, 60 to 80 lbs the year after, and 30 to 40 lbs the year after that. In fact, any cover crop that is plowed under will release nitrogen as the crop decomposes. This is the origin of the term "green manure."

Many plants produce substances that are toxic to other plants. The study of this phenomenon is called "allelopathy." Varro's observation was explained by the discovery of a substance called juglone - a natural herbicide produced by the roots of walnut trees. Many plants have allelopathic effects including sunflowers, cucumbers, oats, alfalfa, rye and tobacco. When these crops are planted prior to other crops, weed pressure is reduced.

Enhancing environmental conditions for growth

Maple trees can move groundwater from their lower roots to the upper roots, where it is exuded into the soil. Herbaceous plants can use this groundwater when conditions are dry. Shade tolerant plants often grow better under the trees than away from them.

Certain garden plants grow better if provided with some shade, while others need to be elevated above the ground to capture sunlight. Leaf lettuce grows well in the shade provided by taller crops. Rhododendrons and azaleas thrive under pine trees. Corn growers will often seed clover between rows so it will germinate after the corn is established. The clover grows throughout the fall and winter after the corn is harvested, increasing soil nitrogen when it decomposes the following spring.

Grasses often are planted between rows of perennial crops such as fruit trees. The grass alleys cool the soil, prevent erosion, improve water penetration, exclude weeds, and harbor beneficial insects.

Reducing pest damage

Most plants produce defensive chemicals that help fend off insects and diseases. These chemicals may be insect poisons, feeding deterrents or have fungicidal properties. The roots of some French and African marigolds contain a substance which is toxic to certain types of nematodes. Nematodes are soil inhabiting microscopic roundworms that damage many species of plants. Certain nematodes can be eliminated from a site by growing a thick crop of marigolds for one season prior to planting the vegetable or fruit crop, or by interplanting marigolds between crop rows.

Destructive insects often locate their food by smell. Many plants, especially culinary herbs, produce strong scents which may confuse insect pests looking for a host to feed on. Garden vegetable plants such as garlic, onions, chives, and herbs such as catnip, horehound, wormwood, basil, tansy, and mints all produce scents which seem to repel insects or mask the scents which attract insects. A certain level of insect protection can be achieved by carefully interplanting some of these as companions to vegetables.

Many insect pests have specific food preferences while others feed on a wide assortment of hosts. Even those species which feed on a wide variety of hosts, such as Japanese beetles, have preferences for certain plants. It is possible to plant a preferred host as a trap crop near the plant that is being protected. Once the insects have settled on the "trap" crop, they can be killed periodically by spraying, without having to treat the protected plants.

Many insects are helpful because they eat or parasitize harmful insects. Most species of wasps and spiders are beneficial as are ground beetles, praying mantids, lady bugs, pirate bugs, and several species of flies. It is possible to attract beneficial insects by planting flowers near the garden. Dill, parsley, carrot, coriander, angelica, and parsnip feature flat topped clusters of small flowers that have strong fragrances. They also seem to attract large numbers of beneficial insects, particularly predatory wasps and flies. This characteristic makes them good candidates for companion planting.

Some Practical Steps

Avoid monoculture in terms of space and time. A one-hundred foot long row of broccoli presents a large target for a cabbage moth that is flying by, but the same number of cabbage plants scattered over several thousand square feet, and interplanted with other crops, is less obvious and attractive to the insect. Pests which routinely plague large, commercial plantings of crops may never be a problem in the diversified home garden.

Know thy friends and avoid killing them inadvertently. Learn to recognize beneficial insects as well as the pests, and note which plants are attractive to beneficial insects. Less than 1% of insects are garden pests.

Plant dill, marigolds, chives, onions, parsley, basil and other flowers throughout the garden. Allow parsley, carrot and celery to remain in the ground over the winter. They will produce flowers the second season and attract beneficial insects. Also, plant strong smelling herbs among vegetable crops.

Try some combinations that folklore says are effective companions. Chives could be planted at the base of roses to repel aphids, garlic could be planted at the base of peach trees to repel borers; basil planted among tomatoes may repel tomato hornworms; nasturtiums grown near squash may repel squash bugs; tomatoes planted among asparagus may repel asparagus beetles; and marigolds, mint, thyme, or chamomile may repel cabbage moths. Radishes make excellent trap crops for cucumber beetles among squash and cucumbers. Radishes also attract flea beetles when planted near cole crops. Garden borders planted with low growing thyme or lavender may deter slugs. Tansy and pennyroyal repel ants.

Observe your plantings carefully, and write down combinations that seem to work for pest control and growth enhancement. Communicate your observations with others. Try to replicate your observations or have others try the same combinations. Testimonials that are shared by many observers often turn out to be valid. Scientists have not spent much time looking at these relationships among plants and their community; furthermore, the number of possible combinations is enormous. You can be the first one to discover a new set of compatible plants!

Bad Science

Unfortunately, much of the popular literature that discusses companion planting is based upon some very bad science, in particular, the "sensitive crystallization method" which was originated by Dr. Ehrenfried E. Pfeiffer in the 1930's. Dr. Pfeiffer was a student of Dr. Rudolf Steiner, the founder of "Biodynamics." The sensitive crystallization method utilizes chromatography to discover why plants make good or bad companions.

Dr. Pfeiffer made chromatograms of many different plants, both individually and in combination. He concluded that mixtures of plants which formed clear and bright chromatograms were mutually beneficial, while mixtures that formed cloudy or dull chromatograms were antagonistic. Thus, the notion that "carrots love tomatoes" but "beans dislike fennel" is based upon an analytical laboratory procedure and not on direct observation of the plants in nature. No legitimate scientist believes that this method can determine compatibility among plant species.

Dr. Pfeiffer also made chromatograms of many other substances including chemical fertilizers and compost. According to Louise Riotte in her book Carrots Love Tomatoes, "the chemical (fertilizer) yielded chromatograms that were dull and lifeless but the ones made from the compost were brilliant with color." Ms. Riotte continues by asking "Could this have been because of the living microorganisms continued in the compost? This supposition seems logical."

Unfortunately, the supposition is not the least bit logical from a scientific viewpoint, and has no relevance for determining plant nutritional needs. It is this type of bad science that has created a hostility between the scientific community and many proponents of biodynamic gardening.

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