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The Myth of Companion Plantings

"Certain species will thrive, lean on, nestle with, and support each other in groupings"

The Myth

Anthropomorphism – assigning human characteristics to other species - allows people to feel more connected to the rest of the living world. Who hasn't bestowed their pet with humanizing characteristics? It is in this context that the notion of "companion plants" first evolved many centuries ago. Historically, plants were associated with the four elements (earth, air, fire and water) and/or signs of the zodiac. One of the outcomes of this categorization was the agricultural practice of planting together those species that "love" each other (an anthropomorphism reflected in the titles of at least two popular books on companion plants). The phrase "companion plant" has since entered the vernacular of both science and pseudoscience, so that its intended meaning is unclear. Is the concept of companion planting a legitimate horticultural practice?

The Reality

Plants, being immobile, must either adapt to their environment or alter it to survive. The alterations are often physical or chemical in nature. The mere presence of a single plant will modify environmental variables including temperature, soil moisture content, soil pH, solar radiation availability (both in terms quantity and quality of light), and nutrient availability. These changes can affect the ability of other plants to survive; those that have a narrow range of tolerance for environmental change will be less adapted to their new environment and may die out. Other species that can tolerate or even require the changes can become established in their stead. Thus, a landscape will pass through successional changes, as the interactions among the living components continue to modify environmental factors. Some of these interactions are positive for associated species, and others are negative. Changes that affect multiple species in positive ways can often develop into mutually beneficial associations among those species.

This is a big picture view and it might help to look at a specific example to see how the concept of companion plants arose. In North America, Indians historically planted corn, beans and squash together in an intercropping system called "Three Sisters". Beans are nitrogen-fixers and continually supply this macronutrient to the soil. Corn stalks provide structure for beans to climb, and squash vines provide a living mulch with their broad leaves that shade the soil, reducing evaporation and inhibiting weed seed germination. These three species have similar environmental requirements and don't outcompete each other for water and nutrients, thus allowing all three species to survive.

The problem with using the phrase "companion plants" is that it is broadly used to describe plant interactions in the realms of science, pseudoscience, and the occult. A Google search of the phrase turns up nearly 10,000 hits on every type of web site imaginable – but only slightly more than 200 of these are .edu sites. On such sites and in the scientific literature there are credible and intriguing studies demonstrating the mutualistic relationships among companion plants and their associated, beneficial insects and microbes. On less credible sites and in some popular books are the pseudoscientific claims that companion plants can be determined by "sensitive crystallization" of their extracts (i.e. to discover which plants "love" each other), or through study of a plant's "rhythm, its vibration, its music, and its note." When the science gets lost in the supernatural, then it's time for academicians and professionals to consider using different terminology.

Fortunately, there are several alternate phrases or terms with precise definitions that can be used in lieu of companion planting. "Intercropping" and "polyculture" are commonly used to describe agricultural production methods using mutually beneficial species. Ecologists use "plant associations" to define natural relationships among plants in non-agricultural situations. This latter phrase is my own choice for discussing the science behind plant interactions.

Researchers have documented several benefits in planting and maintaining diverse plant associations (PAs). Much of the work in this area has studied the effect of PAs on insects. Diverse plantings will attract and retain beneficial insects, including the predator and parasitoid species so important for IPM (Integrated Pest Management) and PHC (Plant Health Care) strategies. Furthermore, the presence of several species in a given area disrupts the ability of many herbivorous insects to discover their appropriate host plants for feeding or egg-laying, apparently through both visual and olfactory mis-cues. The theory suggests that time wasted on non-host plants reduces reproductive efficiency of specialist insects, as they consume metabolic resources on aborted host selection events. Interestingly, one study reported that traditional "companion plants", including aromatics like *Mentha* spp., had little or no disruptive effect on insect behavior, indicating that this characteristic alone may not be very useful in selecting PAs.

Increasing research on below-ground plant relationships has revealed that many plants share root system connections, primarily through mycorrhizal relationships. Mycorrhizae can transfer nutrients such as nitrogen between plant species, facilitating the growth of the receiver plant. Often, these receiver plants are completely dependent on these associations during some stage of their life and cannot survive without the donor.

Plants can directly benefit other plant species manifest in other ways as well. Some plants from arid climates accumulate salts and can be used as desalinating partners for salt-sensitive species. Others adapted to high mineral soils can accumulate and sequester heavy metals from soils, decreasing their toxic effects on other species. Nitrogen-fixing species, such as those in the legume family, provide this nutrient to other plants and microbes in their immediate vicinity. Nurse plants provide shade and moderate the microclimate for new germinants. All of these benefits of PAs have been documented through research and used in the management of agricultural, ornamental, and restoration landscapes.

There is no scientific basis, however, for any of the several lists that exist describing "traditional companion plants". Like horoscopes, these lists may be fun to use, but they should not be perceived or promoted as scientifically valid any more than astrology. Furthermore, those of us who value the science behind our horticultural practices should avoid using this phrase for precisely the same reason.

The Bottom Line

- The phrase "companion plant" is too vague to be useful to plant scientists and professionals; "intercropping" and "plant associations" are more definable and credible
- Documented benefits from plant associations include physical, chemical, and biological alterations that can improve the establishment and survival of desired plant species
- Pseudoscientific, mythological and occult applications of "companion plantings" are not scientific and will damage your credibility as a professional
- Traditional "companion plant" charts have entertainment, not scientific, value

For more information, please visit Dr. Chalker-Scott's web page at http://www.theinformedgardener.com.