Designing an Organic System:
Cover Crops, Crop Rotation & Beneficial Microbes

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One of the more significant challenges to understanding organic farming is recognizing that it is a systems-based approach to production—that successful organic farms thrive on the synergy that results from the interplay of its various components, activities, and techniques. This contrasts with our conventional reductionist approach which focuses on individual actions and inputs in isolation—always pursuing a "silver bullet." In organic farming, we strive to design systems where rotations, cover crops, cultivation methods, and other practices yield multiple benefits, and we recognize that all actions and inputs have multiple effects, including some that may be harmful or, at least, unintended.

But so much for systems theory and words! It is much more challenging to move beyond theory to the practice of putting a working farm system together. We, at Kerr Center, don't have a process or template for this for diverse farms and circumstances. However, what we do have is our certified organic research farm—the Cannon Horticulture Site—which we consciously designed using a systems approach and we can present as an example.

The Cannon Horticulture Site at the Kerr Center contains four fields, each about .60 acres in size, that are in a long-term planned *bio-extensive* rotation. In bio-extensive rotations, a significant percentage of the producing land is maintained in *green fallow*—season-long cover crops—each year. On the Cannon Site, we dedicate a full 50% of our producing land to green fallow. This is in addition to winter cover cropping, which is routine. While this annual "sacrifice" of half our cropland seems extreme, our system addresses several critical inter-connected objectives.

Bermudagrass and Summer Weed Suppression

The Cannon Site was established on pasture land that was 50%–60% Bermudagrass. Today, Bermudagrass continues to thrive in the conservation strips that border all four fields, but it has been virtually eliminated from the fields except, of course, along the very edges. We accomplish this by attacking the Achilles' heel of Bermudagrass—it's extreme-low tolerance of shade. When we select summer cover crops for green fallow, we choose species like sudangrass or sorghum-sudangrass, which grow tall and provide an abundance of shade that "smothers" Bermudagrass and many other weed species.

The effect is obvious and profound as we rotate green fallow fields to vegetables. There is no Bermudagrass to contend with in the following year. As an added bonus, pressure from other summer weeds—yellow nutsedge, horsenettle, pigweed species—is also remarkably reduced, though the species are present. As a result, we spend minimal time cultivating and hoeing. This is much-appreciated by our student interns who have other things to do and learn.

Reduction of Purchased Fertility Inputs

Many, if not most, organic market farms in the region rely on industrial poultry litter as the primary source of organic matter, nitrogen, and other nutrients. We designed the Cannon system to be much more self-sufficient and avoid this dependency. First of all, cover crops—both summer and winter—provide the needed biomass or organic matter our system requires. Annual sorghums, in particular, generate very large amounts. We also "grow" the bulk of our needed nitrogen through a diversity of legumes in the winter cover crop mix. We are also experimenting with using summer legumes as green fallow—either alone or as companion to annual sorghums. This is feasible now that there is no challenge from Bermudagrass.

An added bonus we gain by growing such large amounts of cover crops is the availability of mulch material. When needed, we mow, dry, and carry the plant-based mulch material to wherever it is needed. This not only reduces the need for another purchased input, but reduces worries about out-sourced plant materials that may harbor weed seeds or be contaminated with persistent herbicides. We have also done some preliminary work with "organic no-till," which entails mechanically killing cover crops, leaving the residue in place as a mulch, and planting or transplanting directly into it.

To improve soil biodiversity and the breakdown of heavy crop and cover crop residues, we also apply compost sprays several times a year. These compost sprays are made from the small quantities of compost and vermicompost we make on-site from manure gathered from the Kerr Ranch bull and horse pens, combined with kitchen wastes, and vegetable and cover crop residues. We make two basic kinds of sprays. Compost *extract* sprays result from dislodging a large proportion of active and dormant biological organisms from a small amount of compost and applying them, as is, to bare soil. Compost *tea* sprays also involve dislodging these organisms, but they are released into a nutrient-rich solution where their numbers are increased. The kinds of organisms "grown" is influenced by water temperature and the kinds of nutrients in solution. Compost tea sprays are best applied to growing cover crop vegetation, rather than to the soil.

Reduction of Pest Control Inputs

The primary reason for crop rotation in conventional as well as organic operations is disease and insect pest suppression. Crop rotations that ensure that crops of the same family do not immediately follow each other in sequence, work to break pest and disease growth cycles and keep many problems at bay. On the Cannon Site, we see that crops of the same family are not planted on the same ground more than once in four years. Through careful mapping and planning, we can stretch this to eight years.

An added benefit of maintaining a lot of biodiversity in crops and cover crops is an abundance of beneficial insect habitat that not only supports pollinators, but the predators and parasites of many vegetable pests.