Enriching Soil Through Cover Cropping

by Kate Tieman

Bare earth under a canopy of orchard contrasts sharply with lush stands carpeted with vegetation, alive with the hum of insects, the flutter of butterflies and the song of birds.

The ancient practice of cover cropping creates these lush carpets. Cover cropping performs many functions: protecting the soil from erosion and the harshness of the sun, tilthing the soil, harvesting nutrients, providing habitat for beneficial insects, building organic matter, attracting and keeping damaging insects off other crops—the list of benefits goes on.

Incorporating the crop into the soil, it becomes "green manure"; when interplanted with a main crop, a "living mulch"; a "smother crop" when used to choke out weeds; a "nurse crop" when saved to help establish a planting, as a quick temporary cover—a "catch crop"; and harvested, it can be made into compost.

Healthy food producing systems depend on living soil, whether it's a tiny tray of sprouts in your kitchen window or 1000 acres of crop. Vibrant, alive soils produce vibrant plants that resist disease and pest predation, which in turn enhance the well being of those that consume them—an interrelated, life enhancing web, each element supporting, and contributing to, the other.

Fertile topsoil contains an abundance of soil life. In a handful of rich friable soil, larger soil animals may be evident including worms, grubs and myriad others. Invisible in this same handful of soil are the microorganisms that are the basis of the entire food chain; the primary workers in the decomposition of organic matter into available nutrients for plant growth. They are not only in the soil, but of it. The microflora in just one gram of soil includes over a billion bacteria, millions of fungi, hundreds of millions of actinomycetes and more than a hundred thousand algae. The same gram also contains microfauna. These microbes are extremely susceptible to soil conditions such as oxygen availability, pH, moisture, temperature, and quality of organic matter. Responding to the incorporation of cover crop residues, the bacteria may double their numbers in 30 minutes.

Humus is a structure of slowly decaying compounds synthesized biochemically or modified from organic matter by soil microorganisms. Humus is a dark brown spongy medium whose structure allows for increased root growth and provides a beneficial microhabitat with a vast interior surface area. It is able to absorb 80 to 90 percent of its weight in water. This moisture-holding capacity alone may make the difference between a successful and unsuccessful crop in a dry year. In addition, humic acid eats away at the rocks and stones in the soil releasing the minerals for plant consumption and increasing soil formation.

A key to soil humification is the stage of growth at which the green manure crop is incorporated into the soil. Mature stalks and stems at the early bloom stage contribute the most to humus buildup. The carbon-to-nitrogen ratio is fairly narrow, meaning that there is enough nitrogen in the residues to facilitate the breakdown of organic matter without drawing excessively on the soil's own reserves.

In our humus-poor drylands, a simple and effective way of developing soils combines sheet mulching and cover cropping. This system has been used successfully to heal areas damaged by overgrazing, ravaged building sites without top soil, and areas where soils have been so compacted, rainwater no longer penetrates.

No preparation of the site is required, though the sheet mulch/cover crop process is enhanced by pre-irrigating the area. Sheet mulch layers of varying thicknesses are placed on the surface and seeds are sown into the manure or compost layer. If straw is used as the top layer of mulch, it often contains sufficient seed to germinate a partial crop (placing a cardboard layer under the mulch is not recommended for a seed sowing regime). Plan this approach to coincide with the rainy season if there is sufficient and consistent enough rainfall to allow for the needs of germinating and developing seeds. Supplemental irrigation may be required.

The choice of cover crop to be sown depends on the desired outcome. Is nitrogen building needed? Is mining of phosphorus or calcium from deeper horizons of the soil desired? Do you need to break up clayey soils? When will the crop be sown—warm or cool season? Is irrigation an issue? Is it a problem if the crop goes to seed? Will there be root competition (as in a young developing orchard)? Are perennial plants or weeds to be used as the crop?

I have found that choosing a guild of plants for cover cropping serves more functions than a limited monocrop system. Guild elements include plants whose deep tap roots break down, impregnating the soil with organic matter deep into the strata. Leguminous plants, in symbiotic relationship with rhizobium bacteria, fix nitrogen on their roots. Fibrous rooted plants have a root mass which will provide an abundance of organic matter in the soil's upper horizon. These same crops in their flowering phase will attract a vast number of beneficial insects (including pollinators and parasitic wasps) which in turn attract bird populations who leave behind phosphorus rich droppings—and occasional seeds— further enhancing diversity and function.

As the cover crop comes to maturation—when seed formation is imminent—it is time to harvest the crop. A tremendous amount of available nutrient and plant vitality goes into the production of seed for annual crops, so if the desired outcome is to make this nutrient available to the soil, it is important to harvest prior to seed production. Conversely, if the goal is to continue cover cropping over a longer period of time, the plants can be left to go to seed to produce crops in ensuing years.

On-site composting, and sheet mulching over a cover crop, can occur simultaneously simply by cutting the crop while green, leaving it in place, then covering it with several inches of dried material such as straw, oak leaves, etc. The roots break down in the soil and the surface mulch is enriched and enlivened with high

nitrogen organic matter. With nitrogen fixing plants, full benefits from the nitrogen nodulation of the rhizobium bacteria is attained only if the roots are separated from the vegetative growth and allowed to decay in the soil.

Bare soil is unnatural. Nature is a passion of creation; her evidence is all about us. Every square inch of earth supports life; only the availability of water and soil limit how much. By feeding the soil, applying the age old tradition of cover cropping, we help sustain ourselves and myriad other creatures both visible and invisible, thereby increasing diversity and enhancing the web of life.

SUGGESTIONS FOR COVER CROPS

Austrian Winter Peas (*Pisum sativum*)
• Legume, fixes nitrogen up to 70 to 125 pounds per acre • attracts beneficial insects • cold hardy • competes with weeds • does well in heavy soils • use in soup • sprouts are edible

Bell Bean, (smaller seeded version of *Vicia faba*)
• legume, fixes nitrogen up to 150 pounds per acre • open soils with its strong root system • attracts beneficial insect • creates lots of biomass

Lab Lab Hyacinth Beans (*Dolichos soudanensis*)
• legume, fixes nitrogen up to 150 ounds per acre • warm weather crop • flowers have insect-repellent qualities • edible substitute for garbanzo beans • will grow with little irrigation

Fava/Broad Beans (*Vicia faba*)
• legume, fixes nitrogen up to 150 pounds per acre • attracts beneficial insects • deep rooted • cool/cold weather crop • protein-rich, edible large seed

Fenugreek (*Trigonella foenum-graceum*)
• legume • cold weather crop • medicinal • excellent for opening heavy soils • aromatic herbage

Lupine (*Lupinus albus*)
• legume, fixes nitrogen up to 50 to 125 pounds per acre • long tap root aerates soil • accumulates soluble phosphorus • attracts bees, beneficial insects • can tolerate any soil except heavy adobe • needs 15+ inches of rainfall • hardy to 16 degrees

Buckwheat (*Fagopyrum esculentum*)
• hot weather crop • smothers weeds • good biomass production • accumulates soluble phophorus • trap crop for thrips during bloom of fruits, vines • attracts beneficial insects • edible sprouts • quick crop • great orchard use • flour production

Buffalo Grass (*Buchloe dactyloides*)
• warm season crop • sod-forming • minimum rainfall 12 inches annually • good for erosion control • spreads and seeds well

Meadow Barley (*Herdeum brachyantherum*)
• short-lived perennial • good orchard use • erosion control characteristics • pioneer plant which gradually gives way to other grasses as site improves • excellent nurse crop • tolerates drought, alkaline soils, infertile and compacted soils

Mustard (*Brassica rapa and Sinapis alba*)
• tremendous root system opens heavy and compacted soils • "mines" calcium from subsoil • will grow in low fertility soils • attracts beneficial insects • cool weather crop

Oil Seed Radish (*Raphanus sativus*)
• active against cyst and string nematodes • oil producing • attracts beneficial insects

Rape (*Brassica napus*)
• breaks up clay soils—strong tap root • dense growth chokes out weeds • turned under has some nematocidal effect • oil producing • attracts bees and beneficial insects

Vetches (*Vicia dasycarpa/Vicia villosa*)
• legume, very high levels of nitrogen fixation • produces substantial amounts of organic matter • chokes out weeds • attracts beneficial insects

Comfrey (*Symphytum officinale*)
• perennial • produces great biomass • large tap root accumulates phosphorus • attracts beneficial insects • medicinal • Beware! every little piece of root will grow another plant. Gophers can spread it into unwanted parts of the landscape

Clovers (*Trifolium spp.*)]
• excellent in specific situations, but can be too water demanding

NOTE:
Don't overlook the value of "weeds" as a cover crop. Dig out plants and look at their root structure. Tap roots penetrate deep into a soil layer, collecting nutrients, creating channels for organic matter, and aerating the soil as they decompose. Fibrous roots provide an abundance of organic matter close to the soil surface (one cubic inch of soil planted to rye contains 1300 feet of roots and root hairs), and accumulate nutrients in the soils upper horizons. They are particularly good systems for erosion control.

SOURCE FOR COVER CROPS:
Happy Valley Farm Supply (great catalog)
PO Box 2209, Grass Valley, California 95945
(916) 272-4769