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No-Till Farming

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Because of the twin crises of increased soil erosion and soaring petroleum costs, a new method called “no-till farming” has been in the spotlight in recent years. Farmers are seeking ways to minimize both the amount of tillage and number of tractor operations. In the Northwest no-till is especially being touted as a means of halting erosion in the dryland farming regions of the Interior. By this method, stubble and crop residues are left on the field, and herbicides are used to control re-growth and weed competition.

Although much research on chemical no-till is still underway, the practice has been slow to catch on. Planting into the remains of a previous crop does reduce soil erosion, but farmers are finding problems with competition from wild grasses and weeds not killed by the herbicides, rodents multiplying in the fields, and lower yields as the result of decreased humus and increased soil acidity. Pathogens in both the soil and crops are also becoming problems in chemical no-till, leading to the need for additional fungicides and pesticides.

A unique, biological approach to no-till farming has been proposed by Wes Jackson, director of The Land Institute in Salina, Kansas. In his book, New Roots for Agriculture, Jackson outlines a breeding program for the development of high yielding perennial grains. Jackson points out that all of our major grain crops are grown as annuals, including wheat, oats, corn, barley, rye, sorghum, rice, and millet. Yet, he says, these grains are all grasses closely related to perennials which have never been developed as food. In his book Jackson was quite conservative in predicting the advent of perennial grains, stating that their development might take fifty years or more. But recent work with agrotriticum, a cross between wheat and perennial wheatgrass, suggests that perennial grains suitable for commercial production could be developed within a decade.

Growing a permanent groundcover to act as a living mulch, and then planting right into it, is another no-till approach with potential for the Northwest. The most sophisticated example of this method is the grain rotation developed in Japan by Masanobu Fukuoka. In much the same way that Fukuoka learned to grow vegetables in a semi-wild fashion in his hillside orchard, he also sought to devise a high yielding method for growing rice, wheat and barley that does not require turning the soil. After years of testing various legumes, Fukuoka concluded that low-growing, mat-forming white clovers were best for forcing out weeds and enriching the soil.

Using techniques described in The One-Straw Revolution, a succession of summer and winter grains is sown directly into the living clover mulch. After the rice and other grains are harvested, all of the straw is returned to the surface where it helps control weeds, retain moisture, build humus, and feed soil microorganisms. Ducks are occasionally allowed into the fields for weeding and manuring, and a little chicken manure is scattered on the fresh straw to aid in decomposition.

Following this pattern, Fukuoka has been able to achieve yields of rice, wheat and barley equal to the highest in Japan, all with hand labor in fields that have not been cultivated for thirty years, and without the use of chemical fertilizers or pesticides. Weeds are controlled and fertility maintained by crop rotations, returning straw to the field, and the living white clover ground cover. Only the grain is removed from the fields. All other nutrients are continually recycled.

In North America, controlled experiments on organic approaches to minimum tillage farming are currently being conducted by the Rodale Experimental Farm in Pennsylvania and by Cornell University in New York. Rodale has conducted trials on growing corn and soybeans in strips tilled into fields of alfalfa as well as trials on tomatoes, corn and winter squash seeded directly into grass and red clover sods. Preliminary trials showed that vegetables planted in holes cut into grass sod and mulched heavily with fresh alfalfa clippings consistently achieved higher yields than controls planted in clean-cultivated fields.

Similar work is being conducted at Cornell. Motivated by the urgent need to reduce soil erosion, improve soil structure, reduce leaching and increase organic matter, researchers are trying a wide range of techniques for growing vegetables in living mulch. They hope that, in this way, soils can be preserved and improved without taking land out of production. Cornell researchers are screening both legumes and grasses for possible use as living mulches when sown between rows of cash crops such as sweet corn, cabbage, beans and beets. In establishing living mulches in new fields they have found it best to sow the grasses or legumes five weeks after planting the main crop. Vegetation in the paths is then controlled either with herbicides or by mowing.

Tests have shown that frequent mowing early in the growing season provides control equal to the use of herbicides. Once the mulches are established they can either be disced in or left as a permanent cover which is then rototilled with 12 inch wide strips for seeding subsequent crops. Out of the 50 grasses and 50 legumes being screened at Cornell, low- growing white clovers have proven most promising. This, of course, is the same conclusion that Masanobu Fukuoka came to after years of observation and experience—white clovers provide the best living mulch for no or minimum-till grain and vegetable production.

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