Use of Green Manures and Cover Crops with SRI[1]

In this discussion of green manure/cover crops (GMCCs), we are not referring to the use of legumes that are monocropped on good farmland and then incorporated into the soil at the flowering stage to improve soil fertility. This is a valid use of biological resources, but by and large, it has not worked for small farmers. A growing number of small farmers are finding it beneficial to grow plants that not only improve the soil but at the same time provide other benefits. These plants may be intercropped with regular crops, or they may be grown in the shade of trees or during the dry season, for instance, and are often harvested before being used as a mulch. Thus, the GMCCs discussed here refer to any crops that have some useful purposes (e.g., weed control, food, fodder, or fuel) in addition to the improvement of soil.

GMCCs have often proved to be very popular when introduced. In southern Brazil, nearly half a million farmers are now using introduced GMCCs. But more important, GMCCs are being developed by farmers themselves all over the world, including virtually all of the countries represented in this conference. At present we know of more than 195 such systems being used around the world sustainably by small farmers, employing some 70 different species of GMCCs, many leguminous but some non-leguminous. Mathematical extrapolation indicates there are probably over 500 such systems. Of the species used, many such as the velvetbean (*Mucuna* spp.), jackbean (*Canavalia ensiformis* or *gladiatus*), lablab bean (*Dolichos lablab*), tefrosia (*Tephrosia candida*), pigeon pea (*Cajanus cajan*), wild sunflower (*Tithonia* spp.), the sesbanias, and the vignas already exist in much of Asia.

Problems to be Solved for Wider SRI Utilization

From the reports for this conference, we see that two of the most important disincentives to the adoption of SRI are (1) the increased weeding problem, and (2) the need to find more plentiful, and less expensive, sources of organic matter for application in the paddies to build up soil quality and microbial populations.

When visiting Madagascar, for instance, I found farmers spending as much as 100 days of labor per hectare per year, transporting organic matter from and to their fields. This is bound to slow down SRI adoption there. In many other areas where paddy rice is produced, there are no nearby wastelands (as there are in Madagascar) where people can gather biomass. The biomass is just not available. Therefore, if SRI is to be a sustainable intervention that does not depend totally on chemical fertilizers, we need to help farmers produce large amounts of biomass in the paddy fields themselves and/or along the bunds.

The Potential Role of GMCCs

GMCCs are an ideal way of overcoming both of these constraints — the weeding problem, and the lack of *in situ* organic matter. We do not have already proven GMCC technologies that we know can be used in every location. The efficient use of GMCCs in SRI fields will depend on plant varieties and practices well suited to the local situation. A good amount of research is still needed to know how best to control weeds and en-

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[1] *This note was contributed by Roland Bunch, COSECHA. For more information on GMCC opportunities, species and practices, he can be contacted at rolando@cosecha.sdnhon.org.hon. A paper entitled "A Proven Alternative to Shifting Agriculture: The Worldwide Experience with Green Manure/Cover Crops," written for different kinds of farming systems is available. This information can be made relevant to SRI improvement.*

hance soil organic matter with selected species. Nevertheless, a number of systems already exist and are available, and many others should be feasible and productive if evaluated and adapted appropriately.

We know that the use of GMCCs is a major need from the fact that farmers are already developing and adopting such systems. In Madagascar, farmers using SRI have already moved in this direction. Many are planting GMCC species such as cowpeas (*Vigna unguiculata*) and mungbeans (*V. radiata*) in their paddies during the dry seasons, and others have begun planting a clover species intercropped with their SRI rice. Other farmers who are not yet using SRI have begun using GMCC species in their paddy systems.

In Vietnam, we find farmers often planting rice bean (*V. umbellata*), soybeans (*Glycine max*) and cowpeas in their paddies during the dry season to improve their soils. On Sumatra and Bali, farmers use cowpeas and mungbeans in the same way, consciously recuperating traditional practices of soil fertility maintenance now that chemical fertilizer has become "too expensive." In central Cambodia, a few farmers have begun broadcasting jackbean seed on their paddies during the dry season — in spite of the seasonal drought and the heavy degradation of their soils with a pH of 3.8 — in order to have biomass when the rains return.

The development and use of these technologies on a serious scientific basis is just beginning. If we are to raise present crop yields, we need to find more species that can be grown during the dry season and, if possible, that provide food and fodder as well as biomass for soil recuperation. This will be important for making SRI sustainable, both economically by reducing costs of production as well as ecologically by maintaining soil fertility and biological activity.

Furthermore, we must do it for reasons of human nutrition. The Green Revolution with its positive impact on cereal production has had the side-effect of drastically reducing the availability of pulses and other grain legumes that provide protein in the rural diet. GMCCs can provide dietary, non-animal-based protein that is sorely needed.

Further Development

Even more beneficial than food crops that can be grown during the dry season on paddies, or non-food producing GMCCs that can be intercropped with rice, will be to find food legumes that can be intercropped with SRI rice. This would enrich the soil at the same time it adds to the agricultural productivity of fields, contributing high-quality food to the diet. If this were possible, the overall productivity of the SRI system would greatly increase once again.

Is this possible? We do not presently know. In Latin America, we say that wherever weeds can grow, GMCCs can grow also. The environmental "niche" that is opened up for weed growth with SRI practice — due to wider plant spacing, reduction in standing water, and more sunlight penetration — could be the very niche that allows the intercropping of food-producing GMCCs with rice (as was traditionally done in Japan). What has been seen as a problem with SRI — its susceptibility to increased weed problems — could become one of its major attractions: controlling weeds in a way that produces high-protein foods, along with fish, eels and other species, together with rice in SRI paddies. We will only know if this is possible if we do the necessary farmer experimentation and research.