

The importance of Green Manure Cover Crops

Green manure cover crops (GMCC) are the cornerstone of sustainable agriculture and should always be included in sound crop rotations. In a no-till system cover crops are incorporated biologically and not by tillage implements. To flatten cover crops and lay them on the ground a knife roller should be used.

Pictures and dimensions of a knife roller can be seen in:

[The Knife Roller A new development for permanent cover cropping systems](#)

Green manure cover crops should:

- Ø be of low cost (seeds)
- Ø be easy to seed and manage
- Ø provide good weed control and shading
- Ø produce a positive residual fertilizer effect on following cash crops
- Ø they should not compete in area, labor, time and space with cash crops

The use of green manure cover crops and crop rotation are the key factors for the unprecedented growth of no-tillage especially in Brazil and Paraguay. Only those farmers that have understood the importance of these practices are obtaining the highest economic benefits from this system. While in some regions of the world no-till farmers concentrate on avoiding tillage, Latin American farmers have understood that adequate production and management of crop residues, and of cover crops, are key issues in the no-tillage system. Cover crops do not cost but will pay. When practiced in monoculture or even in double cropping, i.e. when the same crop or crops are repeated on the same land each year, no-tillage is an imperfect and incomplete system, in which diseases, pests and weeds tend to increase and profits tend to decrease. Adaptive research in this area and technology development, are the most important factors to make no-tillage work, that is, take advantage of all the benefits of the system, reduce weed pressure and increase economic returns!

Good knowledge about green and dry matter production and profitability of green manure cover crops, how to fit them into different crop rotations and what residual effect we can expect of each GMCC planted before the main cash crops is essential for dissemination of their use. A number of publications have contributed in filling this knowledge gap in Latin America (Sorrenson and Montoya, 1984; Monegat, 1991; Derpsch, et al., 1991; Derpsch and Calegari, 1992; Calegari et al., 1992, Kliewer, et al., 2000). Several publications on the use of cover crops have appeared in the US in the last decade, i. e., (Cover crops for clean water, W. L. Hargrove, Ed. 1991; Managing Cover Crops Profitably, SAN - SARE, 1998: www.sare.org). There is increasing information on cover crops also in web sites. Some very recommended web sites with comprehensive information on this topic are:

http://www.notill.org/cover_crops/cover_crops.htm

<http://www.ianr.unl.edu/pubs/FieldCrops/g1146.htm#ccs> (Univ. of Nebraska)

<http://www.kbs.msu.edu/extension/covercrops/home.htm> (MSU, Michigan)

http://www.gov.on.ca/OMAFRA/english/crops/facts/cover_crops01/covercrops.htm

This last one from Ontario, Canada.

Other interesting sites on cover crops are

www.acgreenfix.com,

www.barc.usda.gov/anri/sasl/covercrops.htm,

www.sarep.ucdavis.edu/cgi-bin/ccrop.EXE/show_pubs_5025,

www.cedarmeadowfarm.com and

www.cidicco.hn.

At Cedar Meadow Farms, award winning farmer Steve Groff, will sure be glad to share his experience on using GMCC in no-tillage with vegetable crops.

Many more sites can be found using normal search machines.

According to USDA-ARS (2002). "No matter where you farm, there are cover crop species that meet your need"

In a no-till system the use crop rotation and cover crops is much more important than in conventional tillage systems. Experience has shown, that tillage negates cover crops. We have also to remember that cover crops are essential for producing the mulch needed in the no-tillage system. Cover crops have to be integrated in the agricultural system of each farm and show their beneficial effects. Cover crops, in combination with no-tillage and crop rotations ensure the sustainability of agricultural production. "But, rotation isn't just a helter-skelter array of crops" (Rick Bieber, 2000). Without the knowledge of positive or negative residual effects of one species on the succeeding crop, any attempt of organizing a crop rotation is merely a theoretical model. Not only legumes are adequate green manure cover crops. Black oats for instance (*Avena strigosa Schreb*) are planted on 3,2 million ha only in the States of Paraná and Rio Grande do Sul in Southern Brazil. They are planted on more than 300.000 ha in Paraguay.

Functions of green manure cover crops

Provide soil cover for:

- Ø no-tillage
- Ø increasing water infiltration into the soil
- Ø reducing water evaporation
- Ø reducing soil temperature
- Ø protection against erosion
- Ø reducing weed infestation
- Ø accumulation of organic matter in the soil
- Ø adding and recycling nutrients
- Ø improve soil structure
- Ø promotion of biological soil preparation

Adding of organic matter in the soil is often mentioned in the literature as one of the main objectives of cover crops, but this can in general and especially in warmer climates only be achieved in the no-tillage system.

Benefits of green manure cover crops

Cover crops are a key element to make sustainable agriculture possible and have shown the following benefits in Latin America:

- Ø Higher economic returns when appropriately chosen
- Ø Reduce the need for herbicides and pesticides
- Ø Improve yields of following cash crops

- Ø Conserve soil moisture (when properly managed)
- Ø Prevent soil erosion
- Ø Enhance organic matter content of the soil
- Ø Provide nitrogen
- Ø Avoid leaching of nutrients and improve soil fertility
- Ø Reduce fertilizer costs

Literature:

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Hargrove, W. L., 1991: Ed. Cover Crops for Clean Water. Proceedings of an international conference. West Tennessee Experiment Station, April 9 – 11, 1991, Published by the Soil and Water Conservation Society.

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Monegat, C., 1991: Plantas de cobertura do solo. Características e manejo em pequenas propriedades.

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The Knife Roller A new development for permanent cover cropping systems

Green Manure Cover Crops (GMCC's) and crop rotation are the key factors for the unprecedented growth of no-tillage especially in Brazil and Paraguay. Linked to the spread of cover crops is the use of a **Knife Roller** to flatten cover crops. This implement is not terribly expensive and in many cases can be made locally or by the farmer himself. The implement can be pulled by medium sized tractors or the smaller version by animal traction and has contributed a lot in reducing herbicide rates in the no-tillage system. The **Knife Roller** has become an essential tool for managing GMCC's in many countries of South America. The knives should not cut the plants but just smash the stems, in order to impede water circulation in the plant. It has been a big error of many manufacturers to make the implement with sharp knives. In this case knives penetrate into the soil enhancing weed germination

Dimensions of a Knife Roller:

The Knife Roller consists of a hollow steel cylinder, 6mm thick, approx. 115 - 200 cm wide and 60 -70 cm in diameter.

Ends are welded to be filled with water if needed.

Approx. 8 - 12 blunt knives are placed every 19 cm.

The knives are about 7 - 10 cm high and are placed parallel to the cylinder at an angle of 45° or 90°.

Weight of each 200 cm cylinder is aprox. 400 kg empty and 800 kg full of water.

Three cylinders are often placed in such a way that two run in front and one in back allowing for greater working width.

Cylinders are mounted on a frame to allow hydraulic lifting.



The Knife Roller to flatten and kill green manure cover crops and leave the plant residues on the soil surface is an essential tool for cover crop management.