MULCH COVER

A Practical Guide for Comparing Crop Management Practices

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International Maize and Wheat Improvement Center

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The International Maize and Wheat Improvement Center, known by its Spanish acronym, CIMMYT® (www.cimmyt.org), is a not-for-profit research and training organization with partners in over 100 countries. The center works to sustainably increase the productivity of maize and wheat systems and thus ensure global food security and reduce poverty. The center's outputs and services include improved maize and wheat varieties and cropping systems, the conservation of maize and wheat genetic resources, and capacity building. CIMMYT belongs to and is funded by the Consultative Group on International Agricultural Research (CGIAR) (www.cgiar.org) and also receives support from national governments, foundations, development banks, and other public and private agencies. CIMMYT is particularly grateful for the generous, unrestricted funding that has kept the center strong and effective over many years.

Mulch Cover

1. Introduction

Mulch cover is formed when crop residues are retained on a field. Mulch cover is considered an important natural resource for conserving and improving the soil, especially in conservation agriculture. In conservation agriculture, zero tillage with residue retention can improve yields compared to conventional agriculture, whereas zero tillage without this crop residue can drastically reduce yield (Govaerts et al., 2004, 2005; Verhulst et al., 2010). The positive characteristics of mulch cover include soil erosion control, reduction of run-off and improvement of infiltration (Coolman and Hoyt, 1993; Langdale et al., 1994). Further to this, water stress can also be reduced as mulch cover reflects light and functions as an insulating cover on the soil, thereby reducing evaporation. This also influences the soil temperature, where the temperature of the mulch can be up to 10°C higher than bare soil, the temperature under the cover can be up to 10°C lower than a bare soil surface (Mitchell and Tell, 1976). Consequently, relative humidity has been shown to be higher under mulch covers compared to bare soil (Bond et al., 1969; Gupta et al., 1983; Coolman and Hoyt, 1993), along with increased levels of soil biological activity and improvements in chemical properties (Doran, 1980). During the growing season there is usually a reduction in mulch cover, as it is broken down by micro-organisms, releasing nutrients into the system. In this protocol, a simple yet effective method to measure mulch cover is described that does not require experience or special equipment.

2. Materials and Equipment

- Stick
- Ruler
- Datasheet and pencil

3. Procedure

Firstly, you will need to determine how the measurement is to be taken. This will depend on different aspects, such as the arrangement of the plots, the type of crop, and the cropping system. Important factors to determine are the length of the measurement, its location, and its orientation within the plot. The length will depend on the distance between rows, beds and furrows within the plot. For example, when wheat is sown on the flat the length can be determined as a multiple of the distance between rows, while when sown in raised beds it can be determined as a multiple of the bed width. A length of 150 cm was chosen at CIMMYT to measure two 0.75 m beds, consisting of two wheat rows in each bed, and will be used as an example in this protocol. The most important consideration is that the chosen length yields representative results for the experiment. The most representative orientation will most often be perpendicular to the direction of sowing.

Avoid measuring mulch cover in locations of the plot where other factors may influence the result, and when cover is being monitored over time select the same locations on each occasion. To reduce errors, the measurement is divided into five sub-measurements. In the CIMMYT example the sub-measurements are each 30 cm in length; this distance was chosen for convenience as it is the length of a 30 cm ruler. For each 30 cm length the portion covered by mulch is estimated. Alternatively, in treatments where there is a high degree of mulch cover, the length of bare soil is measured. It is important to record which of these factors has been measured.

The 150 cm stick is placed on the ground, perpendicular to the direction of sowing. If you are measuring in a bed-planting system begin the measurement from the left border of the first bed and extend the stick over the following furrow and bed until the right border of the

second furrow. Figure 1 details this measurement, where a total of 6 cm of mulch cover is encountered along the line of the stick (150 cm, represented by the grey arrow). The total number is determined by combining measurements from each 30 cm section (e.g., 2.0 + 0.5 + 2.0 + 1.5 + 0 cm).

4. Calculations

Mulch cover (*Cov%*) is calculated as a percentage of mulch covered soil along the line of the stick:

$$Cov\ \% = \frac{Cover}{Length} \times 100$$

Alternatively, when bare soil is measured:

$$Cov\ \% = \frac{Length\text{-}Bare}{Length} \times 100$$

Where:

Cover = total length of mulch cover (cm)

Bare = total length of bare soil (cm)

Length = total length of the measurement (cm)

5. Worked Example

In a plot of 8 beds of 13 m lenght, two measurements are taken. The first measurement is taken in the first half of the second and third bed, and the other in the second half of the sixth and seventh bed. Mulch cover is estimated visually five times during the growing season (right before planting, around day 40, 80, 120 and before harvest). The numbers generated in Figure 1 can be used as an example for one of these measurements:

$$Cov\ \% = \frac{2 + 0.5 + 2 + 1.5}{150} \times 100 = 4\ \%$$

6. References

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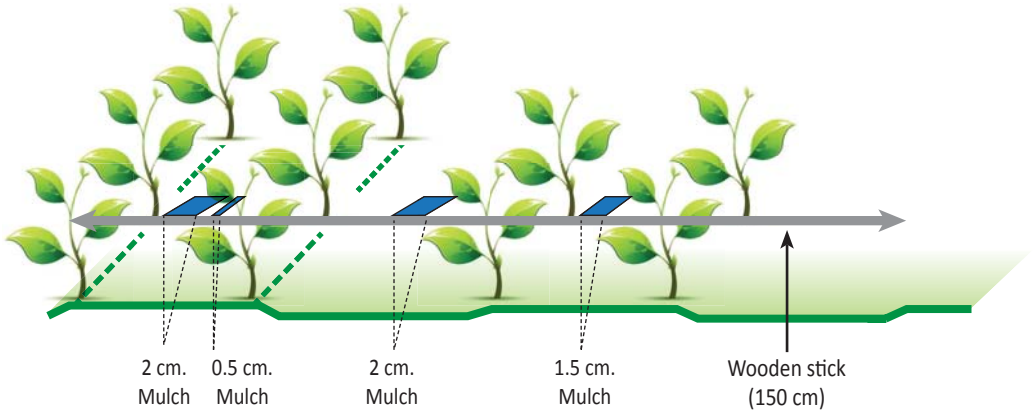

Figure 1. Placement of the ruler and location of mulch cover within a plot.

Data Sheet – Mulch Cover **Page ……./…….**

Measurement date: ……../………/……….. Experiment: ___________________________

Plot No.	Soil (S) or Mulch (M)	Length covered or bare soil (cm)
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