OBTENTION OF REFERENCE VALUE IN THE MEASUREMENT OF THE COVER FRACTION IN CONSERVATION AGRICULTURE SYSTEMS

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Abstract:

The increased concern caused by the high soil loss rates **occurring** in the Andalusian countryside, is forcing farmers to adopt new agricultural techniques, like tillage reduction in extensive systems. In order to assess the efficiency of the alternative systems as a soil conservation method the degree of surface cover needs to be evaluated. The purpose of this work is the establisment of a new method to evaluate the cover fraction. This method is the "Subjective Sector Evaluation",**which is** an alternative method **to the** Transect method.

Keywords: Cover fraction, crop residue, conservation agriculture.

1. Introduction

Southern Spain soils are subject to intense erosion processes, this phenomenon being worsened by the land topography and the applied tillage systems, which leave them unprotected by removing the vegetation in the rainy seasons of autumn and winter. Conservation Agriculture, which maintains the crop residues on the soil, is the best method to conserve soil and water. The characterization of the residue is important and should be as suitable as possible.

Traditionally the "Transect Method" has been used to obtain the fraction of surface cover from crop remains to characterize the residue (Laflen et al. 1981), but it has proved to be a method with a low precision (Rickman et al., 1998). An alternative estimation system has been developed called "Sector Evaluation Method" (Agrela, 2003) in which a square land surface is subdivided into subsectors and the plant cover is estimated in each one. Finally, the mean cover fraction of all the sectors is calculated. This system can be applied in the field in a similar way to the Transect method but it makes it possible to know with a greater precision the cover fraction in a series of soil samples with residue covers, because the Transect method only uses two values at each observation point 0 or 1, while the Sector Evaluation Method evaluates each sector from 0 to 5.

When assessing the crop remains estimation systems in Conservation Agriculture, we should dispose of a method which enables us to find out the measurement of the cover fraction as accurately as possible, and this is denominated "*Contrast Method".* One contrast method used in a previous work was the "Cover Truth" (Agrela et al., 2001) or the "Transparency Method" (Corak et al. 1995). These are tedious methods as it is necessary to visualize the land surface on a computer screen, superimpose a transparent film paper, mark the areas with residues with a special pen, and finally obtain the percentage of soil covered with a software of pixel counters by computer. The Sector method can be used as a contrast method, applying it on a large number of Sectors to improve precision and with various observers estimating the same sample.

2. Materials and Methods

The "Evaluation by Sectors" method is based on the application of a series of scores in small cells or sectors over a defined cropping land surface, on which there is a certain residue cover. Figure 1 shows a sample of 50x50 cm^2 and 25 interior sectors of 10x10 cm^2. The evaluations are subjective, namely, that each observer decides what value to apply on each reticule, giving them values in accordance with clear and defined criteria, and this we call "Trained Subjectivity".

Figure 1 -Frame of 50 cm x 50 xm with grid of 25 sectors for evaluation per sector. An evaluation of sample is included (24.8%).

Table 1 - relation between percentages and scores of 0 a 5, in the Sector Evaluation method

Scores	Percentage interval
0	**0 – 10**
1	**10 – 30**
2	**30 – 50**
3	**50 – 70**
4	**70 – 90**
5	**90 – 100**

Each soil cover sample should be evaluated with the scores shown in Table 1, which correspond to the percentage intervals beside them

The number of samples per plot to be analyzed should be between 15 and 25 if it is aimed to apply a fast measurement with a certain precision directly in the field.

As we increase the number of sectors in the same sample,the precision of the measurement should, in principle, improve. In our work we have included the estimation of the cover on 20 samples, applying the method over 25 sectors once, and subsequently applying it on the same samples in 100 sectors (Fig.2), with three different observers carrying out the estimations.

On calculating the mean of each of these three measurements obtained from each of the observers, the theoretical reference value is obtained, i.e. the value of the cover fraction nearest to the real value. The application of the method in small Sectors can help us to evaluate and compare other estimation methods of the cover fraction, such as those mentioned above.

Each of the evaluation batteries was timed to obtain the time taken in evaluating the 20 samples, applying the method in 25 and 100 sectors, in each of the different observers. It was therefore possible to find out the mean time taken in valuing some samples in comparison to the number of sectors applied.

3. Results and discussion

During the farming year 02/03 samplings have been carried out in the Tomejil estate (Carmona - Sevilla) situated in the plain of the River Guadalquivir in which different soil management systems are assayed.This paper includes the results obtained in a sampling made in October, 2002, in estimating the wheat residue in two different plots. The Sector method was applied with each sample being valued by three different people directly in the field (Figure 2). The average value obtained estimated the cover better and faster than the transect method.

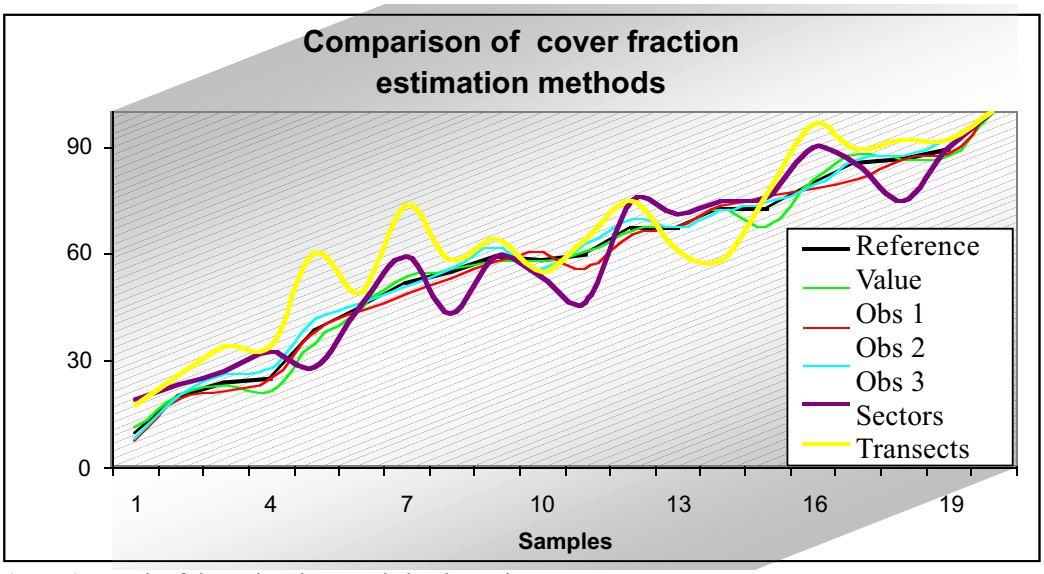

Figure 2. Result of the estimations made by three observers

The mean times obtained from the execution of the method by the different observers were those appearing in Table 2. It is observed that when evaluating on 25 sectors, the measurement was taken in under 1 minute. In the application of the method on 100 sectors, we obtain a mean of 3 minutes of time employed in the evaluation of each sample, i.e. 2.26 secs is taken in the application over 25 sectors and 1.8 secs over 100 sectors.

Table 2 – Time employed in cover fraccion estimation by "Sectors Evaluation Method".

Samples	Mean time for sample
25 Sectors	54 sg/sample
100 Sect. – 1 obs.	167 sg/sp
100 Sect. – 2 obs.	221 sg/sp
100 Sect. – 3 obs.	154 sg/sp
100 Sect. – Prom.	180 sg/sp

4. Conclusions

The characterization of crop residues by means of the Sectors method reflects more precision than that obtained by the traditional Transect method, but the observer who is to carry out the estimation should be previously trained. Applying the method over a larger amount of sectors raises the method's precision.In the event that it is wished to know the cover fraction value of a certain plot with precision, the Sectors method should be applied on a sample of 50x50 cm^2 subdivided into 100 sectors (10x10) and this estimation should be performed by at least 3 different trained observers. This method should be applied on approximately 20 samples per plot.

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