International Journal of Agriculture Sciences
ISSN: 0975-3710&E-ISSN: 0975-9107, Volume 8, Issue 31, 2016, pp.-1655-1656.
Available online at http://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

TEMPORAL VARIABILITY OF LEVELLING INDICES AS INFLUENCED BY DIFFERENT LAND LEVELLING METHODS

KANANNAVAR P.S.*, BALAKRISHNAN P., CHILUR R.S., RAVINDRA Y., KUMAR MANOJ AND BASAVARAJ

University of Agricultural Sciences Raichur, Karnataka, India
*Corresponding Author: Email-pskanannavar@gmail.com

Received: April 17, 2016; Revised: April 28, 2016; Accepted: April 30, 2016; Published: September 01, 2016

Abstract- Land development is one of the prime components of precision farming. Unevenness of agricultural fields leads to the in-efficient use of irrigation water, which in turn reduces the yield and farm income. Levelling index, which is a dynamic factor, determines the quality and accuracy of land levelling. Therefore, it is imperative to study the temporal variability of levelling indices. A field experiment was conducted at two different duration *viz.*, 2009-2010 and 2012-2013 in the research farms of UAS, Raichur, Karnataka state. The study was taken up during the year 2009-10 as first observation to find levelling index of the fields by different methods *viz.,* the conventional levelling and the tractor operated laser guided land leveller. A comparative evaluation of the laser guided land leveller with the conventional system of levelling revealed that, the percentage reduction in standard deviation of reduced levels at grid points of 10X10 m with-in the field for before and after levelling was 85.7 % for laser levelling, and that of 46.79 % for the conventional method which was 38.91 % lower when compared with the laser levelling. The levelling indices before and after conventional levelling were 0.18 m and 0.10 m and the same for before and after laser levelling were 0.17 m and 0.02 m respectively. During the year 2012-13, the levelling indices of the fields levelled by conventional and laser levelling methods were 0.20 m and 0.07 m respectively. The standard deviation of reduced levels for fields levelled by conventional and laser levelling methods were 0.25 m and 0.08 m respectively. Though the temporal variability with respect to levelling indices was observed in both conventional and laser levelled fields, the lesser variations were found in laser levelled field.

Keywords- Temporal variability, Levelling index, Laser levelling, Conventional levelling.

Citation: Kanannavar P.S., et al., (2016) Temporal Variability of Levelling Indices as Influenced by Different Land Levelling Methods. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 8, Issue 31, pp.-1655-1656.

Academic Editor / Reviewer: Srigiri Mallikarjuna, S K Karthik

Introduction

In agriculture, land development plays a key role because undulating topography of the soil surface has a major effect on the germination, water saving and crop yield. Traditional methods of levelling lands are more cumbersome and time-consuming. A significant (20-25 %) amount of irrigation water is lost during its application at the farm due to poor farm design and unevenness of the field [2]. Land levelling saves irrigation water and facilitates field operation and increases yield [4]. For an efficient irrigation system the level difference between high and low spots of a field should not exceed 20 mm whereas under actual field conditions, a difference of 50 to 100 mm is very common. Hence dynamic levelling parameters such as standard deviation of elevations and levelling index determine the accuracy of levelling can be achieved by laser levelling technique. The quantity and quality of the land levelling should be known before and to the irrigator for better planning of the surface irrigation systems. The land levelling quality should quantitatively reflect the precision of the field levelling. The precision the land levelling may depend upon the volume of the earthwork in the cut or fill with reference to the desired plain in an area. The term 'levelling index' (LI) is used to represent levelling quality quantitatively. For agricultural sustainability the variability needs to be avoided. So the present study to find the temporal variability of levelling parameters in different methods of levelling was carried out in the research farms of University of Agricultural Sciences (UAS), Raichur, Karnataka.

Materials and Methods

In this study, comparative evaluation of temporal variability of levelling indices of the fields levelled with the laser guided land leveller with the existing system of levelling was made. A commercial unit of laser guided land leveller (Spectra Precision Pvt. Ltd. Model AG-401) was used for the study. The laser-controlled system as shown in [Fig-1] consisted of (i) Laser transmitter with a tripod, (ii) Laser eye-receiver, (iii) Laser plane receiver, (iv) Control box, (v) Twin solenoid hydraulic control valve and (vi) Drag scrapper.

The plots were divided into two portions. In one portion, the levelling operation was carried out using the laser guided land leveller, whereas, in the second portion, the control box switch was set to MANUAL and levelling carried out by using judgment and skill of the tractor driver. The levelling indices of both the fields before and after levelling were calculated during 2009-'10 and also in 2012-'13 using the formula given by [1].

Levelling index:

[1] Defined the levelling index as the average numerical variation between the proposed or designed levels and existing average field level either before or after the completion of levelling work. It may be expressed as

$$\text{Levelling index} = \frac{\sum \text{Numerical difference between the designed and existing grid levels}}{\text{Number of grid points}}$$

The upper limit of levelling index is zero, which can be achieved only in a perfectly levelled field. Increased values of levelling index reduce the irrigation efficiency. It

is, therefore, essential to assess the quantitatively the effect of land levelling index on irrigation efficiency. The impact of precision levelling was observed with respect to the levelling parameters and their temporal variations.

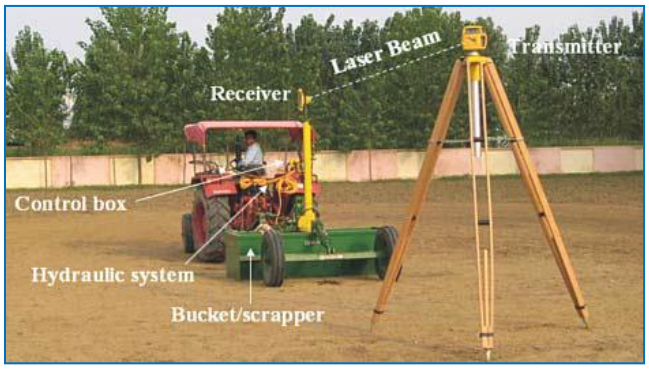

Fig-1 Diagram showing thematic flow chart of laser levelling concept and components fitted in a tractor

Results

From [Table-1] It was observed that the standard deviation of reduced levels before levelling was 0.21 m and after levelling is 0.03 m, using the laser leveller for levelling the field. The standard deviation of reduced levels before levelling was 0.23 m and after levelling was 0.12 m using the conventional leveller. The 85.70 % standard deviation was reduced in the case of laser levelling, whereas, for the conventional method it was 46.79 %, which was 39 % lower than the laser levelling. Similar observations were made by [3]. Hence the accuracy of levelling using laser leveller was higher with more precision than conventional method since the standard deviation was only 3.07 cm.

The levelling indices before and after conventional levelling were 0.18 m and 0.10 m and the same for before and after laser levelling were 0.17 m and 0.02 m respectively. During the year 2012-'13, the levelling indices of the fields again levelled by conventional method and earlier laser levelled field methods were 0.20 m and 0.07 m respectively. The standard deviation of reduced levels for fields levelled by conventional and laser levelling methods were 0.25 m and 0.08 m respectively.

Table-1 *Variability of Levelling parameters as influenced by levelling methods*

Particulars		2009-'10		2012-'13	
		Laser levelled field	Conventionally levelled field	Laser levelled field	Conventionally levelled field
Standard Deviation, m	Before levelling	0.21	0.23	0.08	0.25
	After levelling	0.03	0.12		
Levelling Index, m	Before levelling	0.17	0.18	0.07	0.20
	After levelling	0.02	0.10		
Increase in Levelling index, m		-		0.05	0.10

Discussion

For the same climatic conditions, though the same cultivation practices were followed in both the fields the temporal variability with respect to levelling indices was observed in both conventional and laser levelled fields. But the lesser variability of levelling indices was observed in laser levelled field *i.e.,* levelling index increased from 0.02 m to 0.07 m (0.05 m increase). This was less as compared to the conventionally levelled field where levelling index increased from 0.1 m to 0.2 m (0.1 m increase). The increase in levelling index indicates the decrease the quality of levelling conditions. This might be attributed to the fact that laser levelled fields maintain the perfectly levelled condition over the years. The deterioration of levelness of the field is quite slow as found with the results. The existing undulations in traditionally levelled fields enhance the pace of destroying the levelness of the field.

Conclusions

1. The precision of levelling was higher in case of laser levelled fields as levelling index was very small
2. With the same conditions the temporal variability of levelling indices was more in case of traditional fields

Acknowledgement

Authors are thankful to all the Officers of the University of Agricultural Sciences, Raichur and Dean (Ag. Engg.) and Head and All Staff of Dept. of Soil and Water Engineering of the College of Agricultural Engineering for their technical and financial support in facilitating a the study.

Conflict of Interest: None declared

References

[1] Agarwal M.C and Goel A.C. (1981) *Agricultural Water Management,* 4, 457-464.

[2] Cook R.L. and Peikert F.W. (1960) *The Journal of American Society of Agricultural Engineers,* 31, 211-214.

[3] Chaudhuri D., Mathankar S.K., Singh V.V. and Shirsat N.A. (2005) Laser guided land leveling for rice crop production. *Paper presented in the 39th annual convention of ISAE* held at Acharya N. G Ranga Agricultural University, Hyderabad during, 9-11, March.

[4] Rickman J.F. (2002) "Manual for laser land leveling". Rice-Wheat Consortium Technical Bulletin Series 5. New Delhi-110 012, India: *Rice-Wheat Consortium for the Indo-Gangetic plains, p24.*