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Research Article

IMPACT OF LAND LEVELLING TECHNIQUES ON WATER SAVING IN GROUNDNUT PRODUCTION

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Abstract- Water conservation by innovative techniques is essential to prevent salinity and land degradation in agricultural production. Therefore, evaluation of water conservation technique of laser land levelling in groundnut production in Karnataka is an important task as it falls under major groundnut growing regions of India. With this in mind the investigations were conducted for 2 years *i.e.* 2013 and 2014 on the impacts of the laser guided land levelling on water saving in groundnut production at Main Agricultural Research Station of the University of Agricultural Sciences Raichur. The results showed that laser land levelling could reduce the water application rates considerably when compared to traditional and no levelling. The highest per cent water saving was observed in laser levelled fields with 0.4 % slope (28.03 and 40.50%) followed by laser levelled fields with 0.2 % slope (23.61 and 36.89%) over traditional and unlevelled fields respectively. Mean of both the laser levelling cases registered 63.68 per cent more water productivity over traditional levelling, indicating more production with less irrigation water. It was established that laser land levelling technique saves precious water with the highest water productivity in groundnut production.

Key words: Groundnut production, Laser land levelling, Water saving, Traditional land levelling

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Introduction

The technical water saving measures remain at the core of the water management practices in areas with less rainfall and irrigation water. For efficient irrigation laser land levelling is often advocated as the most effective water saving method. Review of existing literature on land levelling indicated positive impact on water saving, crop and farm productivity [2]. If it is applied effectively, land levelling increases crop germination and yields and improves water distribution [4]. The precise land levelling methods have resulted in smoother soil surface, reduction in time and water required to irrigate the field, more uniform distribution of water in the field, more uniform moisture environment for crops, more uniform germination and growth of crops. The foremost objective of the laser land levelling is to enhance efficiency of irrigation water, which ultimately saves water leading to higher water productivity. However, no such data on water saving and water productivity impacts of land levelling in groundnut production was available in India in general and Karnataka in particular. Therefore, a study was initiated with general research hypothesis that laser land levelling will result in water saving and increased water productivity and contribute to water conservation in the context of groundnut production in the region as this region falls under major groundnut growing areas of India.

Materials and Methods

The field experiments in the medium textured clay soils of University of Agricultural Sciences (UAS) Raichur during *kharif* seasons of 2013 and 2014 were conducted to see the effect of laser land levelling techniques on water saving in groundnut production. The field experiment was laid out on one ha field with split plot design with levelling methods *viz.,* L_1-laser land levelling with 0.2% slope, L_2-laser land levelling with 0.4% slope, L_3-traditional land levelling method and L_4-no levelling (control) as main treatments and irrigation methods *viz.,* I_1-border strip irrigation and I_2-check basin irrigation as sub-treatments. It was replicated four times.

Laser unit: A commercial unit of laser guided land leveller (Model GL-522) was used for the study and one directional slopes of 0.2 and 0.4% were given. Thematic flow chart of laser levelling concept, fitment connectivity of a laser-controlled levelling system with the control box fitted in a tractor with main components *viz.,* Laser transmitter, laser receiver, hydraulic valve and control box is shown in [Fig-1].

Depth of irrigation water: An irrigation scheduling was carried out in critical stages for groundnut and water supply was stopped when water front reached end of border and check. Irrigation was skipped whenever rainfall occurred. For water saving, depth of irrigation water applied (cm) was computed using the following equation:

$$d = \frac{6qt}{A}$$ ..... [Eq-1]

Where, d = depth of irrigation water applied, cm
q = discharge rate , ls^{-1}
t = time of irrigation , min
A = Area irrigated, m^2

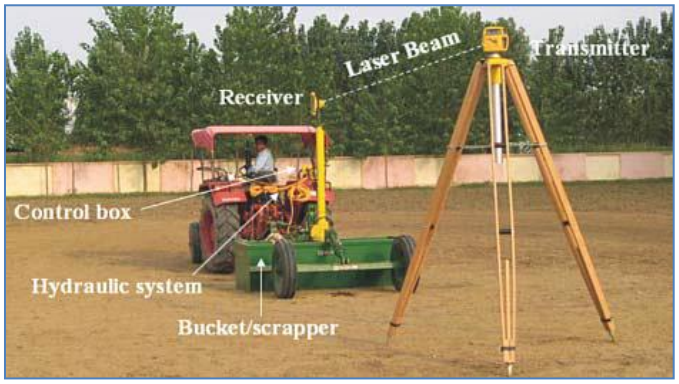

Fig-1 Diagram showing thematic flow chart of laser levelling concept, fitment connectivity of a laser-controlled levelling system with the control box fitted in a tractor

Results and discussion

Depth of irrigation water applied (cm) and per cent saving of irrigation water:

The data regarding depth of irrigation water applied (cm) and per cent water saving as influenced by different land levelling and irrigation methods for groundnut production during the years 2013, 2014 and pooled mean are given in [Table-1]. The data revealed that the plot levelled using laser leveller with 0.4 per cent slope (L_2) required the lowest quantity of irrigation water of 14.1, 17.1 and 15.6 cm, respectively during 2013, 2014 and in pooled mean. It was followed by plot levelled using laser leveller with 0.2 per cent slope (15.2, 18.0 and 16.6 cm, respectively) and traditional levelled plot (19.7, 23.8 and 21.7 cm, respectively). The control plot with no levelling recorded the highest quantity of water usage of 23.6, 29.0 and 26.3 cm, respectively. With respect to water saving the highest per cent water saving was observed in the plot with 0.4 per cent slope, L_2 40.06, 40.92 and 40.54 per cent, respectively during 2013, 2014 and in pooled mean when compared with unlevelled plot (L_4). Whereas, the plot with 0.2 per cent slope (L_1) recorded higher per cent water saving of 35.50, 38.01 and 36.89 respectively. The magnitudes of water saving in traditional levelling method (L_3) were 16.61, 18.01 and 17.38 per cent, respectively over control. Also, laser levelling methods, L_2 recorded water saving of 28.12, 27.95 and 28.03 per cent and L_1 registered 22.65, 24.39 and 23.61 per cent, respectively over traditional method of levelling, L_3 during 2013, 2014 and pooled data. The reason for water saving was mainly due to precise levelling in laser levelled plots leading to smooth and faster water front advance thereby quick uniform distribution of water. But in traditional levelling and unlevelled plots it was not so smooth. Whereas, water has to be applied so that the water reaches the high spots. The similar results on irrigation water requirement and saving were reported by [1], [3-5]. More irrigation water became waste because of field undulations and the crop was subjected to moisture stress at higher spots and excess moisture conditions at lower spots leading to poor aeration and unfavorable environment for plant growth.

Table-1 *Depth of irrigation water applied and per cent saving for groundnut production as influenced by different land levelling methods*

Treatment	Total depth of irrigation water applied (cm)			per cent saving of irrigation water in L_1, L_2 and L_3 over control (L_4)			per cent saving of irrigation water in L_1 and L_2 over traditional (L_3)		
	2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled
L_1	15.2	18.0	16.6	35.50	38.01	36.89	22.65	24.39	23.61
L_2	14.1	17.1	15.6	40.06	40.92	40.54	28.12	27.95	28.03
L_3	19.7	23.8	21.7	16.61	18.01	17.38	--	---	---
L_4	23.6	29.0	26.3	--	--	--	--	--	--

Legend: L_1: Laser land levelling method with 0.2 per cent slope, L_2: Laser land levelling method with 0.4 per cent slope, L_3: Traditional land levelling method L_4: No land levelling (control)

Conclusions

- Laser levelling facilitated precise land development to a desired grade with more ease leading to better-quality irrigation and higher water productivity and over traditional levelling and no levelling.
- Significant quantity of irrigation water was saved in both laser land levelling techniques with 0.2 and 0.4 % slopes as compared to traditional and no levelling methods.
- Laser land levelling by saving water was proved to be a Resource Conservation Technology (RCT) in agricultural production

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Conflict of Interest: None declared

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