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RESEARCH ARTICLE

Performance and evaluation of laser land leveler with conventional method in Allahabad

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ABSTRACT

Land development is the prime components of precision forming. Unevenness of fields leads to in sufficient use of irrigation water. The present study was conducted to evaluate the performance of laser land with conventional method was conducted at Champatpur in Allahabad region. The performance evaluation was done on the basis of actual field capacity, field efficiency, fuel consumption, cost of operation and leveling index with that of conventional method to prove the effectiveness. The operating average speed was varying from 1.5 to 2.50 kmph to evaluate the variables. A comparative evaluation of the laser land leveler with conventional method of leveling showed that the percentage reduction in standard deviation of reduced level, before and after leveling was 85.7 per cent for laser leveler and 46.79 per cent for conventional method, which was 38.91 per cent lower than the laser leveler. From the results of contours analysis, it was observe that considerably higher accuracy of grading was obtained when fields were graded by use of the laser leveler. The field capacity cost of operation for lesar leveler were 0.126 ha/h and Rs. 804.20 ha^{-1}, respectively *i.e.* they were 0.18 ha/h and Rs. 690.24 for conventional leveler, respectively. The cost of leveling per hectare was Rs. 6382.57 and Rs. 3834.67 for laser leveler and conventional leveling.

KEY WORDS : Performance, Evaluation, Laser land leveler, Conventional method

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INTRODUCTION

Precision farming is the need of the hour for increasing the food production for growing population in our country. Land development and scientific irrigation assume key role in precision farming. Cook and Peikert (1960) reported that a significant (20-25%) amount of irrigation water was lost during its application at the farm due to poor farm designing and unevenness of the fields. El-Guindy *et al.* (1994) evaluated the effect of precision land leveling with laser guided land leveler and three tillage treatments. They reported 20 and 22 per cent water saving for wheat and maize, respectively in land leveling. The crop yield also increased by 30 per cent for wheat and 47 per cent for maize. Land leveling is an important operation for good agronomi, soil and crop management practices. Traditional methods of leveling lands are not only more cumbersome and time-consuming but also more expensive. Chaudhari *et al.* (2005) compared the performance of the laser guided land leveler with conventional methods and found that standard deviation of reduced levels varied from 1.9 to 4.4 mm as compared to values of 25.0-30.2 mm for leveling without using laser system. The values of leveling index varied from 1.6 to 3.2 mm for laser guided grading as compared to 15.7-25.4 mm for grading without using laser systems. Field capacity varied from 0.09 to 0.12 ha h^{-1} for laser leveling as compared to 0.11-0.15 ha h^{-1} using laser leveler for land leveling. They concluded that laser leveling was 500 per cent more efficient and time saving than that of traditional system of land leveling.

Most of the rice farmers level their fields very often under pounded water conditions Mathanker *et al.* (2005). They further reported the yield of transplanted rice in India was about 4-5 t ha^{-1} and assuming a 10 per cent increase in yield in the laser-leveled field; an additional 0.4-0.5 t ha^{-1} yield was achievable. For an efficient irrigation system, the level different between high and low spots of a field should not exceed 20 mm, whereas under actual field conditions, a different of 50 to 100 mm is very common. Hence, the present study is an attempt to find the feasibility of a tractor operated laser guided land leveler.

EXPERIMENTAL PROCEDURE

The present study was carried out in the research farm of Sam Higginbottom Institutes of Agriculture, Technology and Sciences, Nani, Allahabad to evaluate the performance of the laser land leveler with the existing system of leveling. In order to eliminate differences in leveler performance due to design of the drag scraper, the same leveler was used for both studies. For evaluating conventional leveling system was not used and the hydraulic system was actuated manually.

A commercial unit of laser guided land leveler (Spectra precision model) was used for the study. The laser controlled system consisted of (i) Laser transmitted with a tripod, (ii) Laser eye-receiver, (iii) Laser plane receiver, (iv) Control box (v) Twin solenoid hydraulic control value, (vi) Drag scrapper.

In order to evaluate accuracy of the laser system, two treatments were taken in this study (a) Leveling with laser land leveler and (b) Leveling with same leveler and prime mover without using the laser plane receiver, *i.e.* conventional or traditional land leveling method. The reduced levels of grid to (10 m x 10 m) were taken prior to and after the leveling operation, by following standard surveying and leveling procedure. No grade (slope) was given to the land. The standard deviations of reduced levels of the grid points were calculated. The field was plowed using a disk plow in order to increase the top soil volume. For a second working, a cultivator was used followed by rotavator to achieve the find tilth of the soil to ensure smooth flow of soil in the leveler scrapper (bucket). All surface residues were cut and removed to aid soil to flow in to the bucket. After the field preparation, a topographic survey was conducted with an auto-level to record the high and low sports in the field. From the surveyed readings, the mean reduced levels of the field could then he established by taking the sum of the reading and dividing by the number of readings taken.

The plot were divided into two portions. In one portion, the leveling operation was carried out using the laser land leveler whereas, in the second portion, the control box switch was set to MANUAL and leveling carried out by using judgment and skill of the tractor driver. In the latter case, for lowering and lifting of the leveler blade, the RAISE and LOWER switches of the control box were used. The reduced levels were taken at all grid points with the help of auto level and leveling staff using survey producers at a spacing of 10 m x 10 m. To determine reduced level of each grid point, height of instrument method of surveying was used. The mean reduced level of the field was determined by adding all reduced levels and dividing by the number of grid points. A new map was then drawn which showed the difference between the mean height of the field and recorded height. The laser controlled bucket was positioned at a point that represents the mean height of the field and the cutting blade should be set slightly above ground level (1-2 cm). The setting was changed to AUTO in control box. Next, the mast was moved up or down till the green light was displayed in the control box. The land leveling was started until all portions of the field showed green light. The tractor was then driven in a circular direction from the high areas to the lower areas in the field. To maximize working efficiency, as soon as the bucket was near filled with soil operator drove towards the lower area. Similarly, as soon as the bucket was near empty the tractor was driven back to higher areas. When the whole field has been covered in the circular manner, a final leveling pass was made in long runs from the high end of the field to the lower end of field. After the operation, grid survey of field was again carried out using the auto level for a subjective assessment of accuracy of leveling, graph were plotted before and after leveling. The graph was plotted against a level field as the base. The costs of leveling per ha, for both the system were also calculated.

EXPERIMENTAL FINDINGS AND ANALYSIS

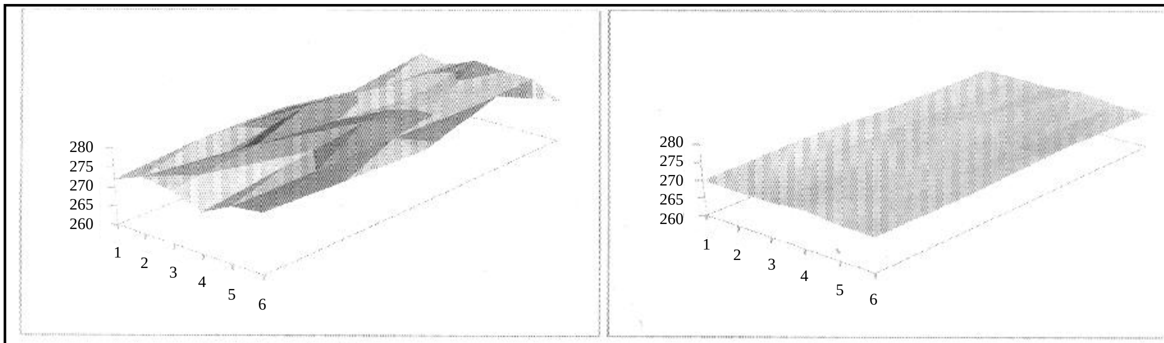
The field particulars, such as length and width related to the selected field for this study are 44 x 23 meter (L x W) with an average area of 1056 m^2. The high value of standard deviation was mainly due to presence of a grade or slope in the field. The elevation height of the field at each 5 m x 5 m grid point for the laser leveling and conventional leveling, namely field number 1 and number 2 shown in Tables 1 and 2, respectively.

Table 1 : Surveyed readings (reduced levels in centimeters) for the field no. 1 before and after laser leveling

Before	After	Before	After	Before	After	Before	After	Before	After
272	270	274	271	274	270	271	270	274	270
275	270	273	270	277	270	274	270	273	270
274	270	277	270	275	271	273	270	276	270
271	271	274	270	277	270	274	271	275	271
275	270	275	270	275	270	274	270	275	270
276	270	275	270	274	271	280	270	271	270

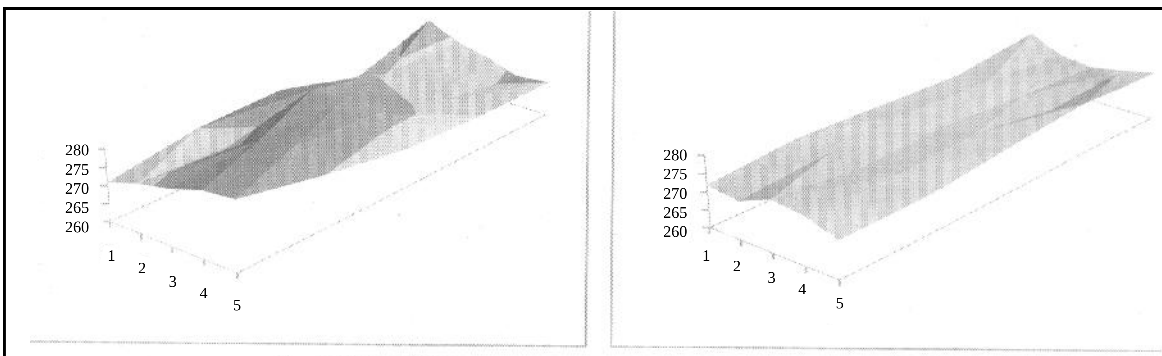
Table 2 : Surveyed readings (reduced levels in centimeters) for the field no. 2 before and after conventional leveling

Before	After	Before	After	Before	After	Before	After	Before	After
271	272	274	271	276	275	279	274	280	271
275	274	273	273	278	272	279	273	275	271
276	273	279	274	279	273	278	274	271	273
270	272	274	273	273	271	272	270	270	275
278	275	274	271	272	270	269	272	270	274



(a) Before leveling (b) After leveling

Fig. 1 : The graph of the field leveled using laser leveler



(a) Before leveling (b) After leveling

Fig. 2 : The graph of the field leveled using conventional leveler

Mean reduced level was 274.43 cm and 274.6 cm for field number 1 and field number 2, respectively. For the field number 1, the drag scrapper was placed at the grid point having a mean reduced level of 271.79 cm and leveled using laser technology as explained. For field number 2, the field was leveled with same leveler without using the laser technology. The reduced levels of the field, observed at each 5 m x 5 m grid point before and after the laser leveling and conventional before and after leveling are shown in Table 1 and Table 2, respectively. From the Table 1 and Table 2 the mean reduced level was 270.2 m and 272.64 m for field number 1 and field number 2, respectively.

The cost of operation of the tractor and leveler combination was calculated both for laser land leveler and conventional leveler. The cost of operation of the laser land leveler was Rs. 804.20 h^{-1} as compared to Rs. 690.24 h^{-1} for the conventional leveler. The cost of operation was 39.91 per cent costlier for the laser land leveler as compared to the conventional leveler. The field capacity of the laser leveler was observed as 0.126 ha h^{-1}, whereas, without using the laser system, the field capacity of the leveler was 0.18 ha h^{-1}.

The fuel consumption of the tractor was 5.5 L h^{-1} for operation of the laser land leveler whereas, laser system was not used the value ws similar. From the above results it may be observed that the field capacity was slightly higher when the laser system was not used. This was due to the fact that there was continuous movement of the tractor and the operator adjust the depth of cut, as per his judgment. However, when laser system was used, the tractor had to stop when the scraper bucket was full and shifted to manual control. The cost of leveling was considerably higher when the laser land leveler was used. The cost of leveling per hectare using the laser land leveler was 6382.57 ha^{-1} and 3834.67 ha^{-1} for conventional leveling. The cost of operation in terms of per unit area was considerably higher when the laser systems of the leveler were in the operation in contrast to grading without use of laser system. This was due to high initial cost of the laser land leveler.

Conclusion :

From the above study, it was concluded that considerably higher accuracy of grading were observed when the fields were graded by use of laser land leveler in comparison to using the leveler without laser systems. The average operating speed of laser land leveler could be 2.5 kmph, working of laser land leveler was found to be optimum at the speed of 2.5 kmph. The fuel consumption with laser land leveler for leveling varied from 5-5.5 l/hr. The field capacity of laser land leveler at 2.50 kmph was 0.126 ha/hr and for conventional method 0.18 ha/hr. The field efficiency for laser land leveler 20.16 per cent and for conventional method was 28.8 per cent at average speed 2.50 kmph. The cost of operation per hectare by laser land leveler was Rs. 6382.57 and cost of operation per hectare by conventional method was Rs. 3834.67.

REFERENCES

Anuraja, B., Kanannavar, P.S., Balakrishnan, P., Pujari, B.T. and Hadimani, M.B. (2013). Laser guided land leveler for precision land development. *Karnataka J. Agric. Sci.*,**26** (2): 271-275.

Chaudhari, D., Mathankar, M.B., Singh, V.V. and Shirsat, N.A. (2005). Performance evaluation of laser guided land leveler for land grading in vertisols of central India. Paper presented in the 39th Annual convention of ISAE held at Acharya N.G. Ranga Agricultural University, Hyderabad during 9-11 March, 2005.

Cook, R.L. and Peikert, F.W. (1960). A comparison of tillage implement. *J. American Soci. Agric. Engineers,* **31** : 221-214.

El-Guindy, A.A., Hasan- El, M.A, Sayd, G. and El-Banna, Osman (1994). Effect of precision land leveling system on wheat and maize production. Paper presented at 2nd Int. Conference on laser and applications, 16-19 September, Cairo, Egypt.

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