

# Laser land leveling

## for enhancing water productivity at field level

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*Efficient water utilization is the need of the time in India in view of the limited water resources and increasing water demand from agriculture as well as from other sectors. Enhancement of agricultural water productivity is essential as agriculture consumes a lion's share of freshwater resources. Precise land leveling is a prerequisite for enhancing agricultural water productivity as it minimizes percolation and surface runoff losses. Use of proper stream size also helps in achieving high water distribution uniformity. Land leveling is essential for scientific water management not only in water scarce areas but also in canal command areas. The investigations on impact of laser land leveling on water productivity and wheat yields were conducted in selected villages in Uttar Pradesh and are presented in the article.*

**Key words:** Laser land leveling, Water productivity

**W**ATER productivity depends on the level of smoothness of the field surface. Land leveling quality, in turn, depends upon the type of leveling equipment and the skill of its operator besides the availability of funds for the purpose. Globally the laser leveling is popular among farmers as it results in higher grain yield coupled with higher water productivity. But in India, laser leveling has been introduced only in last two decades.

### Laser land leveling

Precision land leveling (laser leveling) may be applied as part of a resource management system to:

- improve uniformity of irrigation water application to fields;
- permit uniform and efficient application of irrigation water without causing erosion, loss of water quality, or damage to land by water logging;
- reduce on field and down slope flooding and accumulation of excess

water;

- conserve farm irrigation water; and
- provide for adequate surface drainage.

Several equipments/ methods are available for land leveling operations. Different methods require different field conditions and operating time to complete the task. Laser leveling systems are commonly used in agricultural applications in Australia, Japan and the United States. Increasingly, laser guided systems are



Uniform water application and uniform crop stand in a laser levelled field



being used in developing countries as well. Laser leveling results into a smooth field surface, which facilitates uniform water distribution that results in uniform crop stand.

Accuracy can be improved by as much as 50%. The benefits of laser leveling over other methods include:

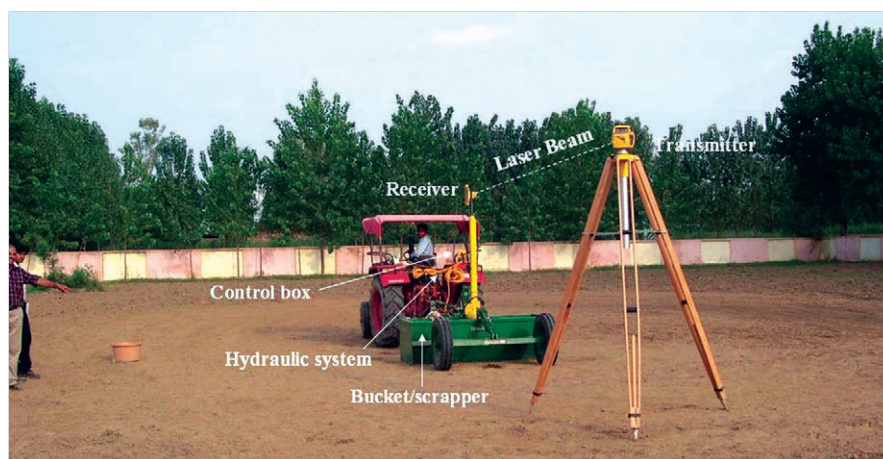
- more level and smooth soil surface,
- reduction in time and water required to irrigate the field,
- more uniform distribution of water in the field,
- more uniform moisture environment for crops,
- more uniform germination and growth of crops,
- reduction in seeds, fertilizer, chemicals and fuel used in cultural cooperation, and
- improved field trafficability (for subsequent operations).

#### Assessment of leveling needs of the fields

Farmers generally take decision about the leveling operation of their fields on the basis of visual judgment. In small field, the chances of amendments are more than the larger fields. Topographic survey on a square grid of 10 m × 10 m was done to assess the leveling needs in terms of expected cuts and fills in case of selected fields. Topographic Index (TI) values were calculated for fifteen fields in all, in two villages namely Lakhan and Masauta, district Ghaziabad, Uttar Pradesh. Increase in TI indicates the increase in unevenness of field surface.

#### Effect of land leveling on water productivity

Total water requirements and the wheat yields of different fields varied as per their topography (TI values). Water productivity was calculated for all the selected fields. Two fields having TI values as 5.8 cm (comparatively smooth field surface) and 26.0 cm (apparently undulating field surface) were identified for presenting the effects of water productivity on land leveling. One crop data of water applied and wheat yield in both these fields was



Laser leveling equipment

**Table 1.** Impact of land leveling on water productivity of wheat

| Before leveling the field,<br>Topography Index, (TI)<br>leveling | 5.8 cm          |                | 26.0 cm         |       |
|------------------------------------------------------------------|-----------------|----------------|-----------------|-------|
|                                                                  | Before leveling | After leveling | Before leveling | After |
| Water applied (M <sup>3</sup> /ha)                               | 2520            | 2325           | 2755            | 2410  |
| Wheat yield (t/ha)                                               | 3.85            | 4.35           | 3.05            | 4.20  |
| Water used (lit/kg wheat)                                        | 654             | 534            | 903             | 573   |
| Water productivity (kg/m <sup>3</sup> )                          | 1.53            | 1.87           | 1.11            | 1.74  |

recorded before leveling. Both the fields were then laser leveled after the wheat crop. Next year again the wheat crop was taken in both the fields and the data of water applied and crop yields were recorded (Table 1). Water productivity values were calculated to determine actual water used in producing wheat in the two fields before and after the laser leveling were estimated and are presented in Table 1. Results indicated that water productivity was high in case of more smooth field (having least TI) and it decreased for undulated field (with higher values of TI).

Water needs of the crop decreased significantly after precise leveling of fields, through laser leveler. Yield of both the fields also increased after land leveling. In unleveled fields having higher TI value (26.0 cm) least yield (3.1 t/ha) was recorded but higher yield (4.1 t/ha) was recorded in the field with lesser TI (5.8 cm). Earlier studies had also reported 26% increase in grain yield of wheat by laser leveling of fields as compared to traditionally leveled field. This is because of better

distribution and less loss of irrigation water in percolation and surface runoff. Water productivity increased more than 50% in the field with higher TI value (TI = 26.0 cm) but only up to 20 % in the field with lower TI value (TI= 5.8 cm).

#### Conclusion

In case of more undulated fields (i.e. higher TI), more irrigation water goes waste in surface runoff and deep percolation and the crop is subjected to moisture stress conditions particularly at higher spots and inundation at lower spots. The water productivity data adequately support the contention that laser leveling reduces the water use in crop production. Also the laser leveling enables uniform distribution of irrigation water resulting in higher yields and better fertilizer utilization. It was also noted that smoother fields permitted larger basin sizes for irrigation saving precious land getting lost in bunds.

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