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Laser land leveling: More about water than about soil

Summary

Laser leveling is not so much about moving soil, but more about using and conserving water resources efficiently. Land leveling using laser-guided leveling equipment is adapted well-tested, easy to implement and efficient technology for saving water, improving water distribution, and increasing irrigation water use efficiency. This all leads to higher yields and more environmentally friendly agricultural production. Laser leveling could be readily introduced on a larger scale in Uzbekistan if appropriate financing and training services for farmers were available.

Background

In Uzbekistan, irrigated agriculture is the only option to cultivate and produce crops. Irrigation water is usually applied as basin or row/furrow irrigation. The application efficiency of water depends heavily on the uniformity of the field. Land leveling is a technique to achieve such uniform micro-topography and is beneficial for the cultivation of all crops.

Land leveling used to be a common practice in Uzbekistan. Nowadays, the majority of the farmers and dehqons rarely



Picture 1: Conventionally leveled field

follow such practices, although they are aware of the negative consequences. When asked, farmers say they do not implement land leveling techniques because they lack funding, appropriate equipment, and skilled labor. At present, more than 60% of irrigated lands suffer from high salinity and groundwater tables resulting from high percolation losses due to non-uniform water distribution in the field; such degradation is a primary cause of yield reductions.



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Conventional leveling vs. laser leveling

The most commonly implemented land-leveling technique is a tractor-drawn leveler with a blade or a bar moving soil from higher elevations to lower ones (Figure 1).

While the land may appear level with this technique, during the irrigation period topographic variations become visible, revealing an uneven distribution of irrigation water. Undulated land conditions resulting from this method higher production costs as the application efficiency of irrigation water depends strongly on the topography of the field. For example, in a field where the topography varies by 10 cm from the highest to the lowest points, an additional application of 1000 m³ water per ha is needed to obtain a similar soil moisture level at the most elevated spots. In addition, when farmers apply excessive amounts of water to compensate for topographical variation, lower elevations are prone to water logging—a very serious and common phenomenon in Uzbekistan. Non-uniform water distribution similarly enhances differences in soil salinization within the same field. Conventional tillage practices, such as land leveling, often move the soil in one single direction, which over time may contribute to uneven soil surfaces. Fields that are unlevelled show an uneven cropping pattern, have a higher rate of weeds, and display uneven maturation rates—all factors which lead to yield losses.



Picture3: Irrigation (left) and crop germination (right) on a laser leveled field

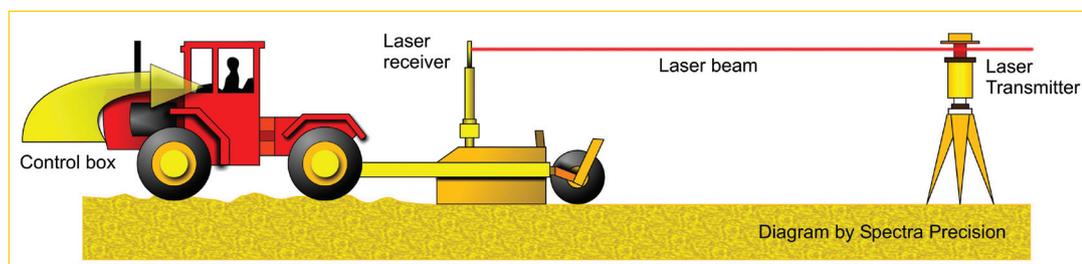


Figure 2: Schematic overview of laser leveling of land.
Source: http://dswcpunjab.gov.in/contents/Laser_Leveling.htm

Laser leveling

Land leveling through laser-guided leveling equipment (figure 2) is a well-tested and efficient technology.

Laser leveled land displays a homogenous surface with improved water distribution, negligible water losses and a high irrigation water application efficiency (picture-3 left). The initial costs of laser leveling are higher than traditionally leveled soils, however, gains in productivity and water conservation arguably offset the initial investment. Not only do water savings exceed 25%, but experience has shown that on laser leveled land, crop germination, establishment, growth and uniformity is significantly improved.

All of these factors combined lead to a reduction in weeds and overall higher yields.

When plowing is done effectively, or conservation tillage practices are being implemented, laser leveling is only necessary every 5-8 years. Water saving also leads to lower energy consumption as a high share of the irrigation water in Uzbekistan is pumped.

It is not expected that each farmer will purchase laser leveling equipment. Instead, the role of private investors on a cooperative basis and/or the creation of enterprises which can provide the necessary equipment is being investigated.

IMPRINT

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