

Research Paper :

Impact of laser land leveler for enhancing water productivity in Western Uttar Pradesh

R.K. NARESH, RAJ K. GUPTA, ASHOK KUMAR, SATYA PRAKESH, S.S. TOMAR, ADESH SINGH, R.C.RATHI, A.K. MISRA AND MADHVENDRA SINGH

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ABSTRACT

Precision agriculture-based resource-conserving technologies (RCTs) in their version of laser-assisted land leveling, introduced at the farm level in the Western Uttar Pradesh of India in 2001, could examine the many issues of the intensive irrigated rice-wheat system. An attempted was made to study the potential benefits and impact of laser-assisted precision land leveling (PLL) in various crops and cropping systems under different agroecologies through farmers participatory researcher-managed on-farm trials. Under on-farm trials conducted in the Western Uttar Pradesh, it was found that PLL enhanced RW system productivity by 10%, with water savings of 22%. Land Leveling is one of the few mechanical inputs in intensively irrigated farming that meets the objective of achieving better crop stand, saving irrigation water and improving the use efficiency of inputs. In recent year considerable efforts have gone in developing and promoting resource conservation technology (RCTs) *i.e.* Zero tillage, bed planting etc. The performance of RCTs can be greatly enhanced through final land leveling. These studies suggest that, to sustain the intensive irrigated systems in general and the RW system of the Western Uttar Pradesh in particular, the integration of laser-assisted precision land leveling with other RCTs could be a viable option. However, the long-term effects of these alternative technologies need to be studied under varying agroecologies.

See end of the article for authors' affiliations

Correspondence to:

R.K. NARESH

Department of Agronomy,
Sardar Vallabhbhai Patel
University of Agriculture and
Technology, MEERUT (U.P.)
INDIA

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Key words : Laser leveling, Resource, Conservation, Water productivity

Shrinking water resources owing to over exploitation of ground water in Western Uttar Pradesh threatens the maintenance of agricultural productivity. As a result, the water table is falling in 60% area of the state. Most of this area falls in the Western part of the state. With the inception of green revolution in the sixties, the water table started declining and the area having water table below 30 feet. depth has increased from 3% in 1973 to 60% in 2006. During 1993-2006, the average fall of water table in the Western Uttar Pradesh was 50 cm per annum. However, in some of the areas, the fall of water table is even more than 80- 100 cm per annum. Out of 819 blocks, there are 85 dark block, 214 grey blocks in the state, of which 67 dark and 86 grey blocks are in western region, 15 dark and 38 grey blocks in central region 12 dark and 90 grey block in eastern region and 1 dark block in Bundelkhand region. In Western Uttar Pradesh out of 70 blocks, the water table in 40 blocks has gone down below 50 cm depth and in these blocks, submersible pumps are

being installed to replace centrifugal pumps. It is projected that by 2025 in Western Uttar Pradesh the water table depth will be below 90 cm in 66% area, below 100 cm in 34% area and below 130 cm in 7% area. Correspondingly in each district, the per cent area below 70 cm depth will be 90% in Agra and Mathura, 80 % in Ghaziabad, 70 % in Baghpat, 60% in Aligarh and Saharanpur. To arrest this dangerous trend of ground water exploitation, there is an urgent need to conserve irrigation water through various on-farm water conservation practices. Land Leveling through Laser Leveler is one such proven technology that is highly useful in conservation of irrigation water.

As per studies, a significant (20-25%) amount of irrigation water is lost during its application at the farm due to poor farm designing and unevenness of the fields. This problem is more pronounced in the case of rice fields. Fields that are not level, have uneven crop stands, increased weed burden and uneven maturing of crops. All these factors lead to reduced yield and poor grain

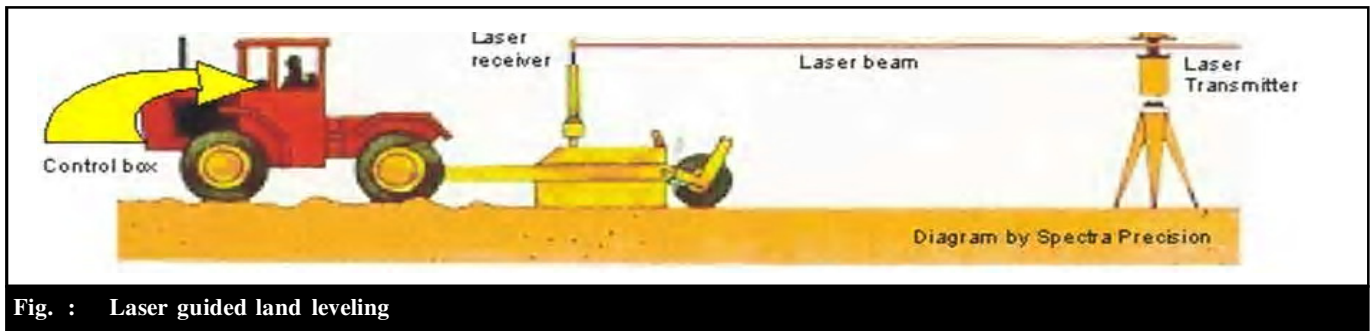


Fig. : Laser guided land leveling

quality. Laser land leveling is leveling the field within certain degree of desired slope using a guided laser beam throughout the field. Unevenness of the soil surface has a significant impact on the germination, stand and yield of crops. Farmers also recognize this and, therefore, devote considerable time resources in leveling their fields properly. However, traditional methods of leveling land are cumbersome, time consuming as well as expensive.

Precision land leveling, what it is?:

Precision land leveling is the process of smoothening the land surface within ± 2 cm from its average elevation mediated by laser technique. Before leveling of field, the survey for recording the elevation of the field is carried out at suitable grid point intervals followed by earth cutting taking average elevation as the minimum depth of cut. Primary tillage with disking of the field is a pre-requisite for land leveling with laser land leveler, which in turn affects the efficiency/accuracy of leveling. Subsequently, earth cutting/removal is carried out.

Irrigation of food crops in India is mostly through surface application methods. As most of the fields are not properly leveled, wastage of land and low irrigation efficiency is a common consequence resulting in lower production consequently precision land leveling is expected to harness higher water productivity and also higher use efficiency of other inputs. Soils having sodicity problem, precision leveling hastens the leaching of salts and the surface drainage, which are crucial for higher productivity of crops. Traditional irrigation practices in unlevelled banded units results in over irrigation. Therefore, excessive loss of irrigation water as deep percolation lowered the application efficiency up to 25 % (Sattar *et al.*, 2003). Precision land leveling helps in controlling the emergence of salt affected patches, increase cultivable land area up to 2-3 %, increases in cropping intensity and crop productivity, improves crop establishment, reduces weed problem, saving in irrigation water etc. Unevenness of the soil surface adversely influences the farming operations, energy use, aeration, crop stand and yield

mainly through nutrient-water interactions. The general practices of land leveling used by the farmers in Western Uttar Pradesh is either through use of planks drawn by draft animals or by small tractors. Farmers in Indo-Gangatic Plains especially Punjab, Haryana and Uttar Pradesh are using iron scrappers/ leveling boards drawn by 4-wheel tractors. But, these leveling practices are not so perfect even after best effort for leveling which results in less input use efficiencies and low yield at the cost of more water. High crop yields depend on optimum seedling emergence, better crop stand and early crop vigour. Laser land leveling is one of the few mechanical inputs in intensively cultivated irrigated farming that meets the twin objectives of achieving a better crop stand, save irrigation water and improves the input use efficiencies.

Land leveling is a precursor to good agronomic, soil and crop management practices and the levelness of the land surface has significant influence on all the farming operations. Hill *et al.* (1991) rated the development of laser technology for precision land leveling as second only to breeding of high yielding varieties. The soil moisture status throughout the field governed by its levelness has great influence not only on farming operations but also the yield and input use efficiency. The leveling of land for achieving higher resource use efficiency is not a new technique but the way in which it is done is not up to the mark as frequent patches of dikes and ditches stretched over a minimum workable distance are created even with best effort by conventional leveling practices. Undulated land hampers the seedbed preparation, seed placement, germination and also requires heavy draught for machines, which leads to consumption of more energy, and ultimately to more cost of production and low productivity levels.

Current status of laser land leveling in Western Uttar Pradesh:

Sardar Vallabh Bhai Patel University of Agriculture and Technology, Meerut (U.P.) in collaboration with Rice-Wheat Consortium, New Delhi and CIMMYT introduced Laser land leveling technology in 2001 under the leadership

List of laser levelers farmers in western Uttar Pradesh

Sr. No.	Year	Month	Name	Address	District	Mobile No.
1.	2001	April	University	S.V.P.U.A.& T	Meerut	9760182606
2.	2005	March	Sh.Sh.Satish Tyagi	Duhai	Ghaziabad	-
3.	2005	May	Sh.Aman Chaudhary	Uphera,Hapur	Ghaziabad	-
4.	2006	February	Sh.Neeraj Choudhary	Chapkoli	Ghaziabad	9758712259
5.	2006	February	Sh.Satish Kumar	Chapkoli	Ghaziabad	9927011373
6.	2006	February	Sh. Surender Kumar	Mahmood Pur	Ghaziabad	-
7.	2006	February	Sh.Ashok Kumar	Rasool Pur	Ghaziabad	-
8.	2006	February	Sh.Jaiveer Singh	ShyamPur,Hapur	Ghaziabad	-
9.	2006	February	Sh.Yashpal Sharma	Dadayra,Hapur	Ghaziabad	-
10.	2006	February	Sh.Surander Singh	Jirothi,Hapur	Ghaziabad	-
11.	2006	February	Sh.Junga Chaudhary	Bayana	Ghaziabad	-
12.	2006	March	Sh.Sonu Kumar	Badang Pur	Ghaziabad	9412118638
13.	2006	March	Sh.Harander Singh	Kuchasar Road,Chopala,	Ghaziabad	-
14.	2006	March	Sh.Sanjay Singh	Pawati	Ghaziabad	-
15.	2006	March	Sh.Anil Chaudhary	Bhikanpur	Ghaziabad	9927317131
16.	2006	March	Sh.Subodh Tyagi	Khadkhari,Hapur	Ghaziabad	9927169798
17.	2006	March	Sh.Amit Tyagi	Attrada	Meerut	9999141514
18.	2006	March	Sh.Pradeep Tyagi	Attrada	Meerut	-
19.	2006	April	Sh.Dushyant Singh	Asodha	Ghaziabad	-
20.	2006	April	Sh.Rishipal Singh	Dadayra,Hapur	Ghaziabad	-
21.	2006	April	Sh.Rajeev Singh	Dadayra,Hapur	Ghaziabad	-
22.	2006	May	Sh.Shiv Kumar	Attrada	Ghaziabad	-
23.	2006	May	Sh.Subodh Kumar	Khad Khadi	Ghaziabad	9927011308
24.	2006	May	Sh.Vijendra Chaudhary	Kajipura	Ghaziabad	-
25.	2006	May	Sh.Aman Singh	Patna,Hapur	Ghaziabad	-
26.	2006	May	Smt Sunhari w/o Hariditya	Dadayra,Hapur	Ghaziabad	-
27.	2006	June	Sh.Pawan Kumar	Mahmood Pur	Ghaziabad	-
28.	2006	June	Sh.Kunwar Pal Singh	Ahamada Nagar	Bulandshahar	-
29.	2007	February	Sh.Brijesh Kumar	Puthi,Jansath	Muzaffarnagar	9927112254
30.	2007	February	Sh.Vinod Choudhary	Kazipur	Ghaziabad	-
31.	2007	February	Sh.Tanuj Choudhary	Shikarpur	Bulandshahar	-
32.	2007	March	Sh.Dharam Pal Singh	Sita Dai,Hapur	Ghaziabad	-
33.	2007	March	Sh. Latoor Singh	Pawahi,Garh	Ghaziabad	9917445999
34.	2007	March	Sh.Manoj Kumar	Pawahi,Garh	Ghaziabad	9756067835
35.	2007	March	Sh.Subodh Kumar	Manpur	Meerut	9927716681
36.	2007	March	Sh.Amit Kumar	Banboi	Bulandshahar	9719515282
37.	2007	March	Sh.Raj Kamal	Kurdi,Deoband	Saharanpur	-
38.	2007	March	Sh.Boby Tyagi	Dhanora,Hapur	Ghaziabad	-
39.	2007	April	Sh.Sheoveer Singh	Ahamada nagar	Bulandshahar	9012039078
40.	2007	April	Sh.Dinesh Kumar Tyagi	Nakepur,Moradnagar	Ghaziabad	9927638208
41.	2007	April	Sh.Harander Singh	Bagad Pur	Ghaziabad	9760238361
42.	2007	April	Sh.Dharam Singh	Narang Pur	J.P.Nagar	9927018373
43.	2007	April	Sh.Arun Kumar	Asoda,Mawana	Meerut	9837865143
44.	2007	May	Sh.Chandra Pal	Narang Pur	J.P.Nagar	9927725907
45.	2007	May	Sh.Yogesh Kumar	Narang Pur	J.P.Nagar	9412449109
46.	2007	May	Sh.Rajander Singh	Narang Pur	J.P.Nagar	-
47.	2007	May	Sh.Sarafat Ali	Narang Pur	J.P.Nagar	-
48.	2007	May	Sh.Arun Kumar	Atora,Mawana	Meerut	9917909778

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49.	2007	May	Sh.Brijesh Kumar	Puthi Ebrahimpur,Jansath	Meerut	9837863254
50.	2007	June	Sh.Irshad Ali	Narang Pur	J.P.Nagar	9758221335
51.	2007	June	Sh.Shah Alam	Ikla Khanpur,Mawana	Meerut	9412632307
52.	2007	June	Sh.Ramveer Singh	Narang Pur,Amroha	J.P.Nagar	9759424020
53.	2007	June	Sh.Bobi Tyagi	Dhanora,Hapur	Ghaziabad	-
54.	2007	June	Sh.Jugander Chaudhary	Bayana	Ghaziabad	-
55.	2007	July	Sh.Chatan Singh	Narang Pur,Amroha	J.P.Nagar	9412839648
56.	2007	July	Sh.Kuldeep Singh	Sarkadi	J.P.Nagar	9837856941
57.	2007	July	Sh.Rajander Singh	Naharola	J.P.Nagar	9837430598
58.	2007	July	Sh.Satpal Singh	Dariya Pur	Moradabad	9758413745
59.	2007	July	Sardar Joravar Singh	Madipura	J.P.Nagar	-
60.	2007	July	Sh.Ved Pal Singh	Patti	J.P.Nagar	9837148085
61.	2007	July	Sh.Rambir Singh	Narang Pur,Amroha	J.P.Nagar	9719167288
62.	2007	August	Sh.Sonpal Singh	Chandnagar	J.P.Nagar	9412633232
63..	2007	August	Sh.Jaikar Singh	Jabdi	Moradabad	9719577076
64.	2007	August	Sh.Bahadur Singh	Jabdi	Moradabad	9412506558
65.	2007	August	Sh.Arkit Kumar	Lalpur,Hapur	Ghaziabad	9917176914
66.	2007	September	Sh.Kiran Pal Singh	Katpura	J.P.Nagar	-
67.	2007	September	Sh.Chattan Singh	Sharikpur	Moradabad	-
68.	2007	September	Sh.AIKesh	Ahmadgarh	Bulandshahar	9216313356
69.	2007	September	Sh.Nepal Singh	Narang pur,Amroha	J.P.Nagar	-
70.	2007	September	Sh.Ashpal Choudhary	Maharoli	Ghaziabad	-
71.	2007	September	Sh.Raj Kishore	Panchi,Hapur	Ghaziabad	-
72.	2007	September	Sh.Ambrish Kumar	Sahapur	Meerut	9917106681
73.	2007	September	Sh.Vinod Kumar	Kijesh	Moradabad	-
74.	2007	September	Sh.Rajveer	Panchi,Hapur	Ghaziabad	-
75.	2007	September	Sh.Chandra Prakash	Atrada,Meerut	Meerut	9412508611
76.	2007	September	Sh.Pratik	Atrada,Meerut	Meerut	9719057449
77.	2007	September	Sh.Raj Kishor	Panchi(Kaili),Hapur	Ghaziabad	989718503
78.	2007	September	Sh.Amrish Kumar	Shahpur Bataoly,Mawana	Meerut	9758419392
79.	2007	September	Sh.Vinod Kumar	Milak (Sukklampur),Garh	Ghaziabad	9758618131
80.	2007	September	Sh.Jaipal Singh	Rohta	Meerut	-
81.	2007	October	Sh.Istiyak Khan	Davyana Tal	Bulandshahar	-
82.	2007	October	Sh. Hitla	Ainchi Kalan,Mawana	Meerut	9917687808
83.	2007	October	Sh.Iqbal Singh	Rahavati,Mawana	Meerut	9719866706
84.	2007	October	Sh.Raj Kumar	Kurdi	Saharanpur	-
85.	2007	October	Sh.Manoj Kumar	Manfora,Jansath	Muzaffarnagar	9837501307
86.	2007	October	Sh.Jaipal Singh	Chapkoli	Ghaziabad	-
87.	2007	October	Sh.Sanjeev Singh	Bahdur Pur	Meerut	-
88.	2007	October	Sh.Kunwar Pal Singh	Ajrada	Ghaziabad	-
89.	2007	October	Sh.Balraj Singh	Chapkoli	Ghaziabad	-
90.	2007	October	Sh.Pradeep Kumar	Khurampur,Moradnagar	Ghaziabad	-
91.	2007	October	Sh.Rai Singh	Harnath pur,Kota	Ghaziabad	-
92.	2007	November	Sh.Irshad Ali	Jaiee,Mawana	Meerut	9997486086
93.	2007	November	Sh.Surander Tyagi	MahmoodPur,Hapur	Ghaziabad	9756429212
94.	2007	November	Sh.Shakel Ahmed	Ajrada	Meerut	-
95.	2007	November	Sh.Sukhdarshan Sharma	Bihira (Jamalpur)	Bulandshahar	9456028483
96.	2007	November	ShBrijesh Kumar	Mukkalampura,Janasath	Muzaffarnagar	9927540069
97.	2007	December	Sh.Hukum Singh	Bhumma,Jansath	Muzaffarnagar	9997136039
98.	2007	December	Sh.Brijpal Singh	Kazmabad Goon	Meerut	9917561108

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99.	2008	February	Sh.Gautam Singh	Mihiwa	Meerut	9837689630
100.	2008	February	Sh.Azadvir	Kasamabad Goon	Meerut	9837234485
101.	2008	February	Sh.Eaj Kumar	Dahana,Hapur	Ghaziabad	-
102.	2008	February	Sh.Anil Kumar	Pawati,Garh	Ghaziabad	-
103.	2008	February	Sh.Dushyant Kumar	Silvai	Ghaziabad	-
104.	2008	February	Sh.Ganga Saran	Bankhanda	Ghaziabad	-
105.	2008	March	S.Harpreet Singh Sandhu	Bijori,Najibabad	Bijnor	979351940
106.	2008	March	Sh.Munesh Kumar	Malakpura,Jansath	Muzaffarnagar	9719659011
107.	2008	March	Sh.Kirpal Singh	Mantori	Muzaffarnagar	9259065807
108.	2008	March	Sh.Subhash Singh	Bhimbyari	Ghaziabad	-
109.	2008	March	Sh.Guddu s/o Sh.Omveer	Dabthala	Meerut	-
110.	2008	March	Sh.Vikas Kumar	Chipyana ,Dasana	Ghaziabad	-
111.	2008	March	Sh.Lillu Tyagi	Kaili	Meerut	-
112.	2008	March	Sh.Ganga Sahaya Singh	Tatarpur,Hapur	Ghaziabad	-
113.	2008	March	Sh.Sheyoraj Singh	Rasool Pur	Ghaziabad	-
114.	2008	March	Sh.Kirpal Singh Tyagi	Jogi Pur	Ghaziabad	-
115.	2008	March	Sh.Ajay Kumar	Nawada	Ghaziabad	-
116.	2008	March	Sh.Krishan Dutt Sharma	Ayad Nagar	Ghaziabad	-
117.	2008	March	Sh.Yogendra Singh	Gandhu Nangla,Simbhawali	Ghaziabad	-
118.	2008	April	Sh.Anil Kumar	Narang Pur	J.P.Nagar	-
119.	2008	April	Sh.Surender Singh	Mahmood Pur	Ghaziabad	-
120.	2008	April	Sh.Kunwar Pal Singh	Malki	Muzaffarnagar	-
121.	2008	April	Sh.Jitendra Singh	Nimchana	Bulandshahr	-
122.	2008	April	Sh.Arun Tyagi	Bara Firozpur	Bulandshahr	-
123.	2008	April	Sanchuri Industries	Hapur	Ghaziabad	-
124.	2008	April	Sh.Satish Singh	Singhpur Sahani, Sambhal	Moradabad	-
125.	2008	April	Sh.Adash Kumar	Mathali	Muzaffarnagar	-
126.	2008	April	Sh.Rajeev Kumar	Bahdur Pur	Meerut	-
127.	2008	April	Sh.Satish Tyagi	Kali,Panchi	Meerut	-
128.	2008	April	Sh.Jagjeeven Ram	Malarbant	Bulandshahar	-
129.	2008	April	Sh.Pradeep Tyagi	Atrada	Meerut	-
130.	2008	April	Sh.Jasveer Choudhary	Mahmood Pur	Ghaziabad	-
131.	2008	May	Sh.Sudhir Kumar	Dudhli,Chota Mawana	Meerut	9259627684
132.	2008	May	Sh.Sahab Singh	Kasampur Khola Jansath,	Muzaffarnagar	9897751435
133.	2008	May	Ch.Aaspal Singh	Mehroli	Ghaziabad	-
134.	2008	May	Master Tikam Singh	Narang Pur	J.P.Nagar	9219362694
135.	2008	May	Sh.Pratik Kumar Tyagi	Atrara	Meerut	9719057449
136.	2008	May	Sh.Dinesh Kumar	Rajpura	Meerut	9717232737
137.	2008	May	Sh.Dilavar Singh	Kasmabad Goon	Meerut	9319021330
138.	2008	May	Sh.Manoj Kumar	Asawar	J.P.Nagar	9837710128
139.	2008	May	Sh.Mahender Singh Saini	Sikandrabad	Bulandshahar	9412584499
140.	2008	May	Sh.Sanjiv Kumar	Kalanjari	Meerut	9756985526
141.	2008	May	Sh.Raj Kumar	Kurdi	Saharanpur	-
142.	2008	May	Sh.Vinay Pradhan	Belda	Muzaffarnagar	9761091685
143.	2008	May	Sh.Roop Singh	Amralla,Modinagar	Ghaziabad	9012934285
144.	2008	May	Sh.Vikram Singh	Badhal,Prikashith Garh	Meerut	9719765118
145.	2008	May	Sh.Amit Kumar	GandhuNangla,Simbhawali	Ghaziabad	9917107474
146.	2008	May	Sh.Dharam Pal Singh	Pota Kabul Pur	Ghaziabad	9917073191
147.	2008	May	Sh.Pramod Kumar	Bharana	Bulandshahar	9719929724

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148.	2008	May	Sh.Rajander Singh	Basumma	Meerut	-
149.	2008	May	Sh.Om Kar Singh	FarmTech Agency,Mawana	Meerut	-
150.	2008	May	Sh.Iqubal Khan	Rahawati	Meerut	-
151.	2008	May	Sh.Sabir Ahmad	Attrada	Meerut	-
152.	2008	May	Sh.Shiv Lal	Jandari	Meerut	9997141514
153.	2008	May	Sh.Prem Kumar	Nabipur	Ghaziabad	9837453132
154.	2008	May	Sh.Surash pal	Kazamabad	Meerut	9761590012
155.	2008	May	Sh.Sukhdarshan	Anchi Khurd	Meerut	9873155799
156.	2008	June	Sh.Raisul Hasan	Jatwara	Muzaffarnagar	9756468786
157.	2008	June	Sh.Ravinder Kumar	Chuchai	Meerut	9761325930
158.	2008	June	Sh.Sayad Hasan	Kasopur Patedhi	Muzaffarnagar	9412379752
159.	2008	June	Sh.Jeet Singh	Chandan Pura	Bijnore	9917947986
160.	2008	June	Sh.Attar Singh Tyagi	Kharkhoda	Meerut	9720522828
161.	2008	June	Sh.Pradeep Kumar	Salarpur	Meerut	9927820804
162.	2008	June	Sh.AKIL kumar	HIMATPUR	Ghaziabad	9720036198
163.	2008	June	Sh.devendra Singh	Chitoli	Ghaziabad	-
164.	2008	June	Sh.MonuS/O Sh.Kirpal Singh	Shyampur	Ghaziabad	9927826980
165.	2008	June	Sh.Mahaveer Singh	Khanpur	Meerut	9213267003
166.	2008	July	Sh.Raj Singh	Mirpur Kalan	Meerut	9758978517
167.	2008	July	Sh.Amit Kumar	Dadari	Ghaziabad	9917190211
168.	2008	July	Mawana Sugar Mills	Mawana	Meerut	-
169.	2008	July	Naglamal Sugar Mills	Naglamal	Meerut	-
170.	2008	July	Titawi Sugar Mills	Titawi	Muzaffarnagar	-
171.	2008	July	Farmtrack Agency	Mawana	Meerut	-
172.	2008	July	Sh.Jugander Choudhary	Lalpur,Hapur	Ghaziabad	9719606042
173.	2008	August	Sh.Krishan Sharma	Astoli	G.B.Nagar	9412387530
174.	2008	August	Sh.Guddu Singh	Dabthala	Meerut	9210793334
175.	2008	August	Sh.Om Kar Singh	FarmTech Agency,Mawana	Meerut	-
176.	2008	August	Sh.Pravinder Singh	Bhadoda	Meerut	9212513356
177.	2008	August	Rajveer Singh	Bhadoda	Meerut	9837839090
178.	2008	August	Smt.Anita Devi	BhokaHadi	Muzaffarnagar	-
179.	2008	August	Sh.Munander Pal	Anchi	Meerut	-
180.	2008	August	Sh.Ballam Singh	Jandheri	Muzaffarnagar	-
181.	2008	September	Sh.Niranjan Kumar	Khaspur	Meerut	9837223244
182.	2008	September	Sh.Virender Kumar	Tigri,Mawana	Meerut	9719645387
183.	2008	September	Sh.Ashok Yadav	Fafunda	Meerut	9359929671
184.	2008	September	Sh.Ashok Kumar	Jandheri	Muzaffarnagar	992747740
185.	2008	September	Sh.Mohan Chauhan	Mattor	Meerut	9927773882
186.	2008	September	Sh.Hari Shankar	Moohamad Pur	Bulandshahar	-
187.	2008	September	Sh.Sudarshan Sharma	Jampur,Gulawathi	Bulandshahar	-
188.	2008	September	Sh.Brijash Kumar	Meerpur	Muzaffarnagar	-
189.	2008	September	Sh. Salim Khan	Pachanda	Muzaffarnagar	-
190.	2008	October	Sh.Naipal Singh	Mantori	Muzaffarnagar	9259319860
191.	2008	October	Sh.Rishipal	Mata Farm Deval	Muzaffarnagar	9760645099
192.	2008	October	Sh.Jitender Kumar	Goon	Meerut	99 17535558
193.	2008	October	Sh.Abid Hasan	Kayasth Baddha	Meerut	9758820065
194.	2008	November	Sh.Ran Singh	Mihiva	Meerut	9758275385
195.	2008	November	Sh.Manoj Kumar	Palehra	Meerut	9927293972
196.	2008	November	Sh.Sansar Pal	Rasulpur	Muzaffarnagar	9756904608

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197.	2008	November	Sh.Nawab Singh	Mantori	Muzaffarnagar	9219808945
198.	2008	November	Sh.Sunil Chaudhary	Pur Baliyan	Muzaffarnagar	9837449626
199.	2008	November	Sh.Om Kar Singh	FarmTech Agency,Mawana	Meerut	-
200.	2008	November	Sh.Vikram Singh	Nanehra	Saharanpur	9012218274
201.	2008	November	Sh.Virender Singh	Salarpur	Muzaffarnagar	9456014367
202.	2008	November	Sh.Mannu Singh	Jiwna	Muzaffarnagar	9411816356
203.	2008	Nivember	Sh.Dhoom Singh	Chuchai	Meerut	9927024193
204.	2008	November	Sh.Ashok Kumar	Jiwna	Muzaffarnagar	9837452311
205.	2008	December	Sh.Hukkam Singh	Thuma	Muzaffarnagar	-
206.	2008	December	Sh.Brajpal Singh	Kadamabad	Meerut	-
207.	2008	December	Sh.Davendar Singh	Chitoli	Ghaziabad	-
208.	2009	January	Sh. Naresh Kumar	Masorie	Meerut	9719201870
209.	2009	January	Sh.Dharam Pal	Poota Kabulpur	Ghaziabad	-
210.	2009	January	Sh.Sat Pal Singh	Bhatiyana	Ghaziabad	-
211.	2009	January	Sh.Sakher Kumar	Nagola	Ghaziabad	-
212.	2009	January	Sh.Gyanendra Singh	Padav	Ghaziabad	-
213.	2009	January	S.Gurdav Singh	Miranpur	Muzaffarnagar	9837804326
214.	2009	February	Sh.Narveer Singh	Mahmoodpur	Ghaziabad	9837909083
215.	2009	February	Sh.Pramod Kumar	Madona	Bulandshahar	-
216.	2009	February	Sh.Rajeev Kumar	Aorangabad	Bulandshahar	9837750977
217.	2009	March	Sh.Munesh Kumar	Malakpura	Muzaffarnagar	9917454691
218.	2009	March	Sh.Rakesh Kumar	Barkatpur	Bulandshahar	9917554259
219.	2009	March	Sh.Bijender Tyagi	Duhai	Ghaziabad	-
220.	2009	March	Sh.Ashok Kumar	Sultanpur	Ghaziabad	9719331162
221.	2009	March	Sh.Bundu Naii	Kawal	Saharanpur	-
222.	2009	March	Lokendra Kumar	Perangarh	Bulandshahar	-
223.	2009	March	Sh.Srree Pal	Badabrola	Bulandshahar	-
224.	2009	March	Sh.Neyaj Mohamad	Norona	Bulandshahar	9411859617
225.	2009	April	Sh.Shree Pal	Andavli	Meerut	9756899073
226.	2009	April	Sh.Babu Ram	Ashapur	Bulandshahar	9759748591
227.	2009	April	Sh.Ashok Solanki	Kurli	Bulandshahar	9411233480
228.	2009	April	Sh.Sanjay Singh	Girdeerpur	Ghaziabad	9837744520
229.	2009	April	Sh.Amit Kumar	Kukda	Muzaffarnagar	9897989848
230.	2009	April	Sh.Vir Pal Singh	Kalakhera,Joya	J.P.Nagar	9690155757
231.	2009	April	Sh.Pramod Kumar	Chitoli	Ghaziabad	9917515969
232.	2009	May	Sh.Amit Kumar	Mubarakpur Tigri	Meerut	9997470213
233.	2009	May	Sh.Guddu	Nanota	Saharanpur	9927302786
234.	2009	May	Sh.Dinesh Kumar	Rajpura	Meerut	9917232737
235.	2009	May	Sh.Vinod Kumar	Rajpura	Meerut	9219208634
236.	2009	May	Sh.Raj Pal Singh	Ikla	Meerut	9837294066
237.	2009	May	Sh.Kuldip Singh	Nasrulah,Garh	Saharanpur	9927203326
238.	2009	May	Sh.Sanjiv Kumar	Saini,Mawana	Meerut	9917152605
239.	2009	May	Sh.Yoginder Singh	Khanzar Pur	Meerut	9837207364
240.	2009	May	Sh.Vaseer Ahmed	Tyala	Ghaziabad	9837124558
241.	2009	May	Sh.Mangu Tyagi	Kandavali	Meerut	9759543652
242.	2009	May	Sh.Madan Pal	Jangathi	Meerut	96908334207
243.	2009	June	Sh.Bhure	Mundali	Meerut	9690119387
244.	2009	June	Sh.Inder Vir Singh	Tejal Hera	Muzaffarnagar	9759797922
245.	2009	June	Sh.Deen Mohd	Mawana	Meerut	9897232572
246.	2009	June	Sh.Chander Vir Singh	Nisurkha	Bulandshahar	9411969878

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Table contd...

247.	2009	June	Mohd. Faizal	Kamaalpur	Meerut	9756683573
248.	2009	June	Sh.Rajesh Kumar Tyagi	Bhikenpur	Ghaziabad	-
249.	2009	June	Sh.Raj Singh	Mawana	Meerut	9758978517
250.	2009	June	Sh.Neetu Chaudhary	Saffipur	Meerut	9927668029
251.	2009	June	Sh.Kirshan Pal	Madona	Bulandshahar	-
252.	2009	July	Sh.Khacheru Singh	Sisoli	Meerut	9368222837
253.	2009	July	Sh.Ram Singh	Asrafpur	Bulandshahar	9012020824
254.	2009	July	Sh.Latoor Singh	Mirjapur	Ghaziabad	9758286446
255.	2009	August	Sh.Guddu s/o Sh.Tilak Ram	Tigri,Mawana	Meerut	999740213
256.	2009	August	Sh.Ram Singh Chauhan	Dorli	Meerut	9758893948
257.	2009	August	Sh.Bijendar Singh	Mudi Bakapur	Bulandshahar	9720319057
258.	2009	August	Sh.Subhash Chaudhary	Mursana	Bulandshahar	-
259.	2009	September	Sh.Gullu Singh	Tugalpur	Muzaffarnagar	-
260.	2009	October	Sh.Azad Vir Singh	Kashopur	Muzaffarnagar	9917473175
261.	2009	October	Sh.Om Pal Singh	Dhikoli,Mawana	Meerut	9319974404
262.	2009	October	Sh.Virender Singh	Jandheri	Muzaffarnagar	9719333739
263.	2009	October	Sh.Pardeep Kumar	Nawada	Meerut	9927573238
264.	2009	October	Sh.Ajit Singh	Lalalhera	J.P.Nagar	9927466489
265.	2009	October	Sh.Surendra Chaudhary	Mahmoodpur,Hapur	Ghaziabad	-
266.	2009	October	Sh.Som Pal Singh	Gangdhari,Khatauli	Muzaffarnagar	9761075603
267.	2009	October	Sh.Harender Singh	Jandheri	Muzaffarnagar	9927919883
268.	2009	October	Sh.Ram Pal Singh	Kheri Manihar	Meerut	8057569872
269.	2009	October	Sh.Shiv Kumar	Pamana Wali	Muzaffarnagar	9761344839
270.	2009	October	Sh.Sanjiv Kumar	Fahimpur	Muzaffarnagar	9639670866
271.	2009	October	Sh.Satish Kumar	Badkali	Muzaffarnagar	9639725121
272.	2009	October	Sh.Sukh Pal Singh	Mandwari	Meerut	9758580465
273.	2009	October	Sh.Lokender Fooji	Pavarsa	Meerut	-
274.	2009	November	Sh.Ram Singh	Mantori	Muzaffarnagar	9319419920
275.	2009	November	Sh.Satish Kumar	Nirganzini	Muzaffarnagar	9917043221
276.	2009	November	Master Surender Singh	Kila Prikshat Garh	Meerut	9997729920
277.	2009	November	Sh.Salek Chand	Mantori	Muzaffarnagar	9027429864
278.	2009	November	Sh.Rajender Singh	Mantori	Muzaffarnagar	9917043221
279.	2009	November	Sh.Rajinder Pandit	Bhainsi,Khatauli	Muzaffarnagar	9837986157
280.	2009	November	Sh.Ashok Kumar	Jiwna	Muzaffarnagar	9837452311
281.	2009	November	Sh.Kunwar Pal	Purbaliyan	Muzaffarnagar	9690762493
282.	2009	November	Sh.Parmod Kumar	Asawar	J.P.Nagar	9837016777
283.	2009	November	Sh.Arun Kumar	Behra Assa	Muzaffarnagar	9411816356
284.	2009	November	Sh.Narender Singh	Mantori	Muzaffarnagar	9557070268
285.	2009	December	Sh.Sat Vir Singh	Singhpur Chandwadi	Moradabad	9456238776
286.	2009	December	Sh.Dharam Vir Singh	Chacharpur,Khatauli	Muzaffarnagar	-
287.	2009	December	Sh.Madan Saini	Tisang,Khatauli	Muzaffarnagar	9917349428
288.	2010	January	Sh.Virender Kumar	Sahbazpur Mandawar	Bijnor	-
289.	2010	January	Sh.Ramdhari	Ukavali	Muzaffarnagar	9634855002
290.	2010	January	Sh.Shakti Singh	Nake	Meerut	9917194221
291.	2010	January	Sh.Parmendar	Bisna Khera	Saharanpur	9927374720
292.	2010	January	Sh.Sajiv Kumar	B.B..Nagar	Bulandshahar	9758242453
293.	2010	January	Sh.Saran Singh	Gunn	Meerut	-
294.	2010	February	Sh.Kuldip Singh	Nasrullah Garh	Saharanpur	9927203326
295.	2010	February	Sh.Anuj	Goyala	Muzaffarnagar	-

Table contd..

Table contd...

296.	2010	February	Sh.Anil Chauhan	Amroha	J.P.Nagar	9837256547
297.	2010	February	Sh.Pawan Kumar	Harvanpur,B.B.Nagar	Bulandshahar	97675091698
298.	2010	February	S.Harpreet Sandhu	Bijori Farm,Najibabad	Bijnor	9719351940
299.	2010	February	Sh.Rishi Pal	Nasurallah Garh	Saharanpur	97589269950
300.	2010	February	Sh.Aamir Ahmad	Meerapur	Muzaffarnagar	-
301.	2010	March	Sh.Bitoo	Mirapur	Saharanpur	9837516449
302.	2010	March	Sh.Manoj Kumar	Chajjupur	Meerut	9939182155
303.	2010	March	Sh.Raj Kumar Sharma	Kina Nagar	Meerut	9634682289
304.	2010	March	Sh.Anuj Kumar	Kheri Pachenda	Muzaffarnagar	-
305.	2010	March	Sh.Set Pal	Tikola,Deoband	Saharanpur	96755170139
306.	2010	March	Sh.Ram Vir Singh	Bagarpur	J.P.Nagar	9719167288
307.	2010	March	Sh.Krishan Pal Singh	Bamori	Meerut	9457031987
308.	2010	March	Sh.Pappu	Pahgam	Mathura	-
309.	2010	March	Sh.Rishi Pal Singh	Siddharhi	Bulandshahar	-
310.	2010	March	Sh.Succha Singh	Hapur	Ghaziabad	-
311.	2010	March	Sh.Satpal Singh	Soobri	Saharanpur	9012474207
312.	2010	March	Sh.Rajeev Kumar	Nathugarhi	Bulandshahar	9719967714
313.	2010	March	Sh.Dharmender	Gandu Nagla	Ghaziabad	-
314.	2010	March	Sh.Subash Singh	Hashupur	Ghaziabad	-
315.	2010	April	Sh.Netash Tyagi	Gudamb	Saharanpur	-
316.	2010	April	Sh.Uttam Singh	Titavi	Muzaffarnagar	-
317.	2010	April	Sh.Kapil Kumar	Bhuddana	Bulandshahar	-
318.	2010	April	Sh.Mahendra Singh	Kharot	Mathura	9812588477
319.	2010	April	Sh.Gaurav Kumar	Candannpur	Bulandshahar	-
320.	2010	April	Sh.Yogash Kumar	Nathugarhi	Bulandshahar	-
321.	2010	April	Sh.Ratan Singh	Hapur	Ghaziabad	-
322.	2010	May	Sh.Parmendar Singh	Bina Khera	Saharanpur	9927374720
323.	2010	May	Sh.Yakub Kuldip	Nasurallah Garh	Saharanpur	9927203326
324.	2010	May	Sh.Ramjani	Kune Hara	Meerut	9719298095
325.	2010	May	Mohd.Abid	Baddhah	Meerut	9758820065
326.	2010	May	Sh.Vinay Kumar	Birpur	Saharanpur	9761040141
327.	2010	May	Sh.Naresh Pal	Ladpur	Ghaziabad	9719294769
328.	2010	May	Sh.Sunil Kumar	Shekhupura Kandela	Muzaffarnagar	9756226542
329.	2010	May	Sh.Babu s/o Sh.Ramadhan	Jandheri	Meerut	9837861138
330.	2010	May	Sh.Virendra Singh	Shun Shine Farm	Bulandshahar	9837193579
331.	2010	May	Sh.V.K.Tyagi	Mor Kuka	Muzaffarnagar	9368155097
332.	2010	May	Sh.Rishi Pal	Nasurallah Garh	Saharanpur	9758926950
333.	2010	May	Sh.Azad Singh	Kasopur	Muzaffarnagar	9917473175
334.	2010	May	Sh.Imran s/o Sh.Nawaz Ali	Nasurallah Garh	Saharanpur	9760772217
335.	2010	May	Sh.Lalit Kumar	Nasurallah Garh	Saharanpur	9719286155
336.	2010	May	S.Gurprit Singh	Jattiwala	Bijnore	9927631499
337.	2010	May	S.Harendra Singh	Kranti Farm	Bijnore	9720810333
338.	2010	May	Sh.Amit Kumar	Morsadarpur	Meerut	9761842911
339.	2010	May	Sh.Raj Pal Singh	Ahrola	Bulandshahar	9457015549
340.	2010	May	Sh.Davraj	Mursana	Bulandshahar	-
341.	2010	May	Sh.Naresh Kumar	Sikree	Bulandshahar	-
342.	2010	May	Sh.Abdul Karim	Meethapur	Bulandshahar	-
343.	2010	May	Sh.JasBeer Singh	Anupsahar	Bulandshahar	-
344.	2010	May	Sh.Mahesh Kumar	Anupsahar	Bulandshahar	-

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Table contd...

345.	2010	May	Sh.Kadam Singh	Nathugarhi	Bulandshahar	-
346.	2010	May	Sh.Dharam Veer	Baharana	Bulandshahar	-
347.	2010	May	Sh.Shiv Dutt Sharma	Putre	Bulandshahar	-
348.	2010	May	Sh.Naveen Kumar	Anupsahar	Bulandshahar	-
349.	2010	June	Sh.Ombir Singh	Lillon	Muzaffarnagar	9557551632
350.	2010	June	Sh.Devinder Singh	Ainchi	Meerut	9917665543
351.	2010	June	Sh.Surendra Chaudhary	Mahmoodpur,Hapur	Ghaziabad	-
352.	2010	June	Sh.Aftab Ali	Thana Bhawan	Muzaffarnagar	9027489591
353.	2010	June	Sh.Naresh Chaudhary	Rajpur	Muzaffarnagar	-
354.	2010	June	s.Surender Singh	Meerapur	Muzaffarnagar	-
355.	2010	June	Mohd.Anwaar Ahmed	Danshari	Muzaffarnagar	-
356.	2010	June	Sh.Bura Singh	Tripura	Haridwar	-
357.	2010	June	Sh.Joni	Rajpur	Muzaffarnagar	-
358.	2010	June	Sh.Jugnu	Parli Ganda	Muzaffarnagar	-
359.	2010	July	Sh.Jag Bir Singh	Jarwada	Muzaffarnagar	-
360.	2010	July	Sh.Rajpal Singh Bhai Ji	Rampur Maniharan	Saharanpur	-
361.	2010	July	Sh.Nathu Singh	Kakroli	Muzaffarnagar	-
362.	2010	July	Ch.Shobeer Singh	Kakroli	Muzaffarnagar	-
363.	2010	July	Sh.Sanjiv Kumar	Kudana	Muzaffarnagar	9895458102
364.	2010	August	Sh.Nathi Ram	Kandhla	Muzaffarnagar	9917228691
365.	2010	November	Sh.Aram Singh	Tanda Amir Nagar,Baheri	Bareilly	8126401770
366.	2010	November	S.Harpreet Singh Randhawa	Chandain Farm,Bilaspur	Rampur	9837306257
367.	2010	November	Sh.Ravinder Singh	Baraut	Baghpat	9027534514
368.	2010	November	Sh.Surbha s/o Sh.Ram Pal	Sarsina	Saharanpur	9897097943
369.	2010	December	Sh.Hari Om	Samaypur	Meerut	7830063945
370.	2010	December	Sh.Virender Singh	Jandheri	Muzaffarnagar	9719333739
371.	2010	December	Sh.Sudesh Kumar	Alipur	Meerut	-
372.	2010	December	Sh.Rakam Singh	Miragpur	Saharanpur	9756250434
373.	2010	December	Sh.Ved Pal Singh	Birla Chandpur	Bijnore	9720911372
374.	2010	December	Sh.Rajesh Kumar Tyagi	Bhikenpur	Ghaziabad	-
375.	2010	December	Sh.Raj Kumar	Kurdi	Saharanpur	-
376.	2010	December	Mohd.Jafar Tanveer	Rudkali	Muzaffarnagar	-
377.	2011	January	Capt.Chanderbal Singh	Jiwna	Muzaffarnagar	8958799932
378.	2011	January	Sh.Ram Chandra	Nona	Muzaffarnagar	9719071501
379.	2011	January	S.INDER Mohan Singh	Ramraj	Muzaffarnagar	9760846509
380.	2011	January	Sh.Bal Ram Singh	Dal heri	Saharanpur	9411080892
381.	2011	January	Sh.Mukesh Kumar	Bandhora,Samli	Muzaffarnagar	-
382.	2011	January	Sh.Asutosh Kumar	Titoshra	Bijnore	9927879672

of Dr.R.K. Naresh. In 2000 University was created and at that time the university had limited resources. So, the laser land leveler was provided to a farmer Mr. Pramod Tyagi of Bayana village in Ghaziabad district of western Uttar Pradesh which was monitored by Dr.R.K.Naresh and his team. Mr. Pramod Tyagi started laser land leveler on custom hiring. Due to the benefits of this technology it became popular among the farmers and it was the only laser land leveler in U.P and it was under the control of university. The farmers of the intensively cultivated areas of the country are inclining towards the proper land

leveling of their fields for précised application of critical inputs and higher economic returns from the farming. In western Uttar Pradesh, large number of farmers became familiar with the laser land leveling technique and many of them are deriving benefits of this technology on their farms. Till date, the laser land leveling system is not manufactured in India and has to be imported from abroad, which is a costly preposition for the farmers. But now a days some private manufacturers are fabricating these laser land leveler. This will boost the precision land leveling mission in India with further refinement in

List of farmers/institutes of other states who purchased laser leveler from Western U.P. distributors

Sr. No.	Month and Year	Name and Address	No. of systems
1.	Feb , 2008	Sh.Mukesh Tyagi, Khudala,Ballabgarh,Haryana	01
2.	April,2009	Sh.RohTash Singh, Kurli, Yamuna Nagar,Haryana	01
3.	May,2008	Krishi Vigyan Kendra, Krukshatra,Haryana	01
4.	June,2008	Krishi Vigyan Kendra,Karnal,Haryana	01
5.	June,2008	Sh.Jagdev Singh,Sirsa,Haryana	01
6.	July,2008	G.B.Pant University of Agriculture & Technology.Pantnagar,U.S. Nagar (U.K.)	01
7.	July,2008	Anand Agricultural University Krishi Vigyan Kendra,Muvaliya,Dahod (Gujarat)	01
9.	Jan.2009	C.S.Azad University of Agriculture & Technology,Kanpur (U.P.)	02
10.	March,2009	Sh. Jagdev Singh,Sirsa,Haryana	02
11.	Dec.2009	Zonal Agricultural Research Station, Mohitnagar, JalpaiguriI (W.B)	01
12.	Dec.2009	Zonal Agricultural Research Station, Krishnanagar,Nadia (W.B)	01
13.	Dec.2009	Zonal Agricultural Research Station, Nalhati, Birbhum (W.B)	01
14.	Dec.2009	Principal Agricultural Training Center,Balurghat,Dakshin,Dinajpur (W.B.)	01
15.	Dec.2009	Bhakuri Model Farm, Baharampur,(W.B.)	01
16.	Dec.2009	Field Crop Research Station, Burdwan (W.B.)	01
17.	Dec.2009	Bongon S.A.R.F., North 24 Parganas.(W.B.)	01
18.	Dec.2009	Mohd.Irfan Khan,Pirpura,HaridwarU.K.	01
19.	Jan.2010	Bidhanchandra Krishi Viswa Vidyalaya, Distt.-Nadia (W.B.)	01
20.	Jan.2010	DASHMESH,Amergarh,Punjab	01
21.	Jan.2010	Sh.Yash Bir Singh,Biswakheri,Haridwar,U.K.Ph. 9719568844	01
22.	Feb.2010	Rice Research Station, Chinsurah,Hooghly,(W.B.)	01
23.	May,2010	Sh.Dharamveer Singh,Hasna,Ballabgarh,Haryana	01
24.	May,2010	Sh.Ajay Tyagi,Gharonda,Ballabgarh,Haryana	01
25.	Sep.2010	Under Directorate of Agricultural,Bihar SAO Ara, Distt. Bhojpur SAO Sherghati, Distt. Gaya SAO Muzaffarpur (West) Distt. Muzaffarpur SAO Benipatti, Distt. Madhubani DFM Odhara, Distt. Banka	05
26.	Dec.2010	Indira Gandhi Krishi VishwavidyalayaI, Krishak Nagar Raipur (C.G.)	01
27.	Dec.2010	CIRB, Hisar,Haryana	01
28.	Dec.2010	SAO, Buxor ,Bihar	01

technology and development of component technologies for improving resource use efficiency under precision land management system. Till date farmers have purchased more than 400 laser land levelers in the area of university jurisdiction and they are using them for custom hiring. Our university had provided training to the farmers on laser leveler. At the time of beginning use of laser leveler

by our university there was not even a single manufacturer and now several manufacturers are working on this.

After analysing the profitability and sustainability of laser levelers and also its importance in conservation agriculture the ministry of agriculture, government of Uttar Pradesh purchased 70 laser levelers for the purpose of training and demonstration to the progressive farmers

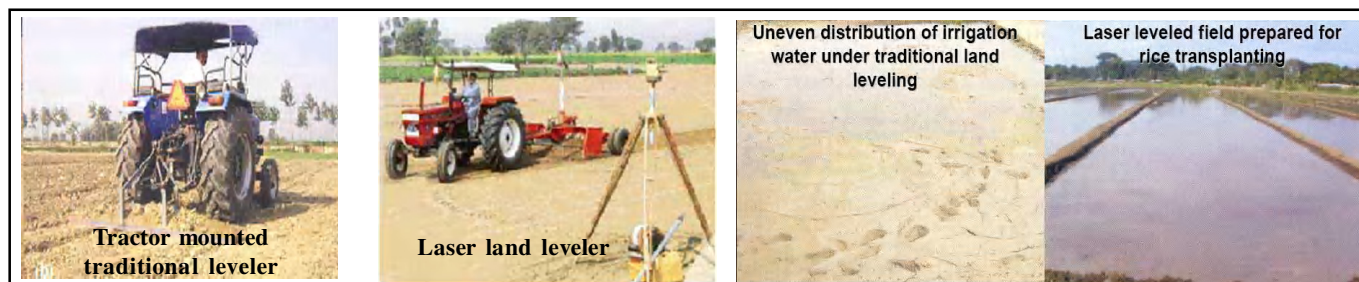




Fig. : Laser leveler in operation

Objectives of land leveling:

Effective land leveling is meant to optimize water use efficiency, improve crop establishment, reduce the irrigation time and effort required to manage crop.

Laser leveled land:

- Improving crop establishment
- Improving uniformity of crop maturity
- Approximately 3% (canal irrigated area) to 6 % (tube well irrigated area) increase in cultivable area
- Has potential to increase water application efficiency by over 50 %
- Increase in water productivity of crops
- Increase in yield of crops (15 to 25 %)
- Approximately 25-30% saving in irrigation water
- Increase in nutrient use efficiency (15- 25 %)
- Reduces weed problems and improves weed control efficiency Laser leveler in operation

Standards for laser land-leveling system:

The quality of the land leveling depends mainly on the compatibility of the laser, bucket/ scrapper and the tractor. The land leveling lasers are standard specifications but their performance depends on the scrapper/bucket size and the power of the tractor to drag them. For précised and efficient operation of the laser land levelers the scrapper size should be as per the standards of the tractors (Table 1) as their availability various regionally.

Table 1 : Standards for size of tractor and scrapper for precision land leveling

Sr. No.	Tractor size (HP)	Scrapper width (m)
1.	30-50	2.0
2.	50-100	2.0-3.0
3.	100-125	3.0-3.5
4.	125-150	3.5-4.0
5.	>150	4.0-4.5

Comparative performance of different land leveling systems:

The working efficiency and quality of land leveling depends on the leveling systems. The working efficiency of the land levelers varies from 0.08 ha to 2.0 ha per day. The accuracy of land leveling in animal drawn and tractor drawn bucket and scappers even with the best efforts is $\pm 4-5$ cm whereas it is ± 1 cm in laser-operated bucket (Table 2).

Table 2 : Comparative performance of different leveling systems

Sr. No.	Leveling system	Working efficiency (ha per day)	Accuracy
1.	Animal	0.08	$\pm 4-5$ cm
2.	Hand tractor	0.12	$\pm 4-5$ cm
3.	Blade	0.5-1.0	$\pm 4-5$ cm
4.	Bucket	0.5-1.0	$\pm 4-5$ cm
5.	Laser	Up to 2	± 1 cm

Cultivable land area:

Evenness of the land surface due to laser land leveling helps in use of larger fields for irrigation in food crops. Increase in plot size for irrigation leads to reduction in number of bunds and channels in the field and brings more area under cultivation. Rickman (2002) reported 5 to 7 % increase in farming area due to precision land leveling. In Punjab and Sind province of Pakistan, 2 to 3 % addition in cultivable area was reported due to precision land leveling (Khan, 1986). Through RRA in western Uttar Pradesh (Naresh *et al.* personal communication, 2003), it has been estimated that about 3 and 6 % additional land area can be brought under cultivation in canal and tube well irrigated areas, respectively (Table 3) due reduction in number of bunds and channels mediated by laser land leveling.

Operational efficiency:

Precision land leveling requires larger fields, which increases the farming area and improves operational efficiency. In on-farm investigations, Rajput and Patel (2003) reported that, the plot size of wheat was increased from 50 x 12 m before leveling to 50 x 20 m after precision leveling and in rice it was increased from 50 x 25 to 50 x 50 m. Increasing field size from 0.1 hectare to 0.5 hectare increases the farming area between 5% and 7%. This increase in farming area gives the farmer the option to reshape the farming area that can reduce operating time by 10 to 15 % (Rickman, 2002). The operational efficiency of tillage operations of a tube well irrigated farm in western Uttar Pradesh was increased by about 22%

Table 3 : Estimated additional land area which can be brought under cultivation due to precision land leveling under rice-wheat cropping system in western Uttar Pradesh

Parameters	Traditional land leveling		Precision land leveling	
	Tube well irrigated	Canal irrigated	Tube well irrigated	Canal irrigated
Plot size (m x m)	30 x 20	40 x 30	40 x 30	50 x 50
Total Plot area (m ²)	600	1200	1200	2500
Area under bunds and channel (m ² ha ⁻¹)	1200	600	600	300
Additional land area brought under cultivation (%)	-	-	6	3

Source: Naresh *et al.* Personal Communication (2003)

Table 4 : Effect of land leveling on operational efficiency and fuel consumption of tractor

Levelness of the field	Time in tillage operation (hr ha ⁻¹)		Fuel consumption* (Lit ha ⁻¹)	
	Cultivator/Rotavator	Harrowing	Cultivator / Rotavator	Harrowing
Traditionally leveled	1.92	2.17	7.35	7.80
Laser leveled	1.50	1.67	5.63	5.87
Difference	0.42	0.50	1.72	1.93
% savings	21.83	23.04	23.40	24.74

*Average diesel consumption of the tractor @ 4.0 lit hr⁻¹

Source : Naresh *et al.* Personal Communication (2003)

Table 5 : Net profit in the first year of laser land leveling on custom hiring

Village	Plot no.	Additional amount of wheat produced due to laser land leveling (Rs.)	Expenditure in laser land leveling (Rs.)	Net profit (Rs.)	Saving in irrigation water (m ³)
Lakhan	516	1750	945	805	584.6
	456	2000	945	1055	406.8
	745	1750	945	805	338.4
Masauta	364	2125	2025	100	807.6

Source: Rajput and Patel (2003)

(Table 4) after precision land leveling (Naresh *et al.*, 2003).

The cost of the operation of one new laser unit was calculated to amount to Rs 3,50,000 comprising fuel (Rs2,57,680 year⁻¹); driver's wages and bonus (Rs30,000year⁻¹); maintenance, repair, insurance, and miscellaneous (Rs54,500 year⁻¹); and interest on investment excluding depreciation (Rs1,30,450 year⁻¹). The gross revenue for the period of engagement was Rs11,44,000year⁻¹ and the net revenue was Rs3,21,370 year⁻¹. In addition, this provides employment to rural youth for nearly 300 person-days annum⁻¹. The hiring charges remained the same irrespective of crop and area under different crops cultivated in laser-leveled land, and savings in irrigation time were derived from the survey data. The savings in irrigation time and water calculated were verified with those of farmers participatory trials fields results before calculation. The benefits estimated for wheat and rice were less than those of vegetables and sugarcane. However, for ease of quantification, the entire

area was assumed to be under rice-wheat. The estimated water savings per ha were 9% and 20%, respectively, for rice and wheat, with corresponding electricity savings of 139.06 and 86.82 units worth Rs. 660 and Rs415 ha⁻¹ (the cost of electricity was reckoned at INR 4.00 unit⁻¹ for computation purposes though the tariff in vogue is a flat rate as per the horse power of the pump set and, in most cases, its diesel run consumes 5 liters h⁻¹ for a 7.5-HP pump set) Fig. 1,2,3&4.

Laser land levelers are estimated to have covered nearly 700,000 ha in Western Uttar Pradesh. In addition to a yield increase of 100–150 kg ha⁻¹ crop⁻¹, laser leveling has generated business of more than Rs15,000,000 and created jobs of around 75,000 person-days for rural youth @ Rs 200 per day.

Conclusion and future needs:

Over the past decade, researchers in association with farmers have been trying to solve the problems of declining farm profitability, depleting water resources, and

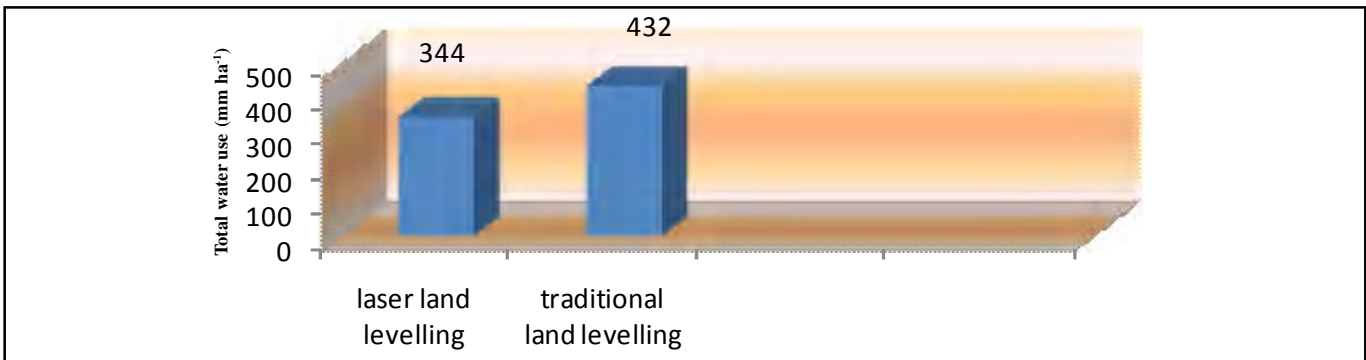


Fig. 1 : Total water use (mm ha⁻¹) in wheat under laser land leveling and traditional land leveling

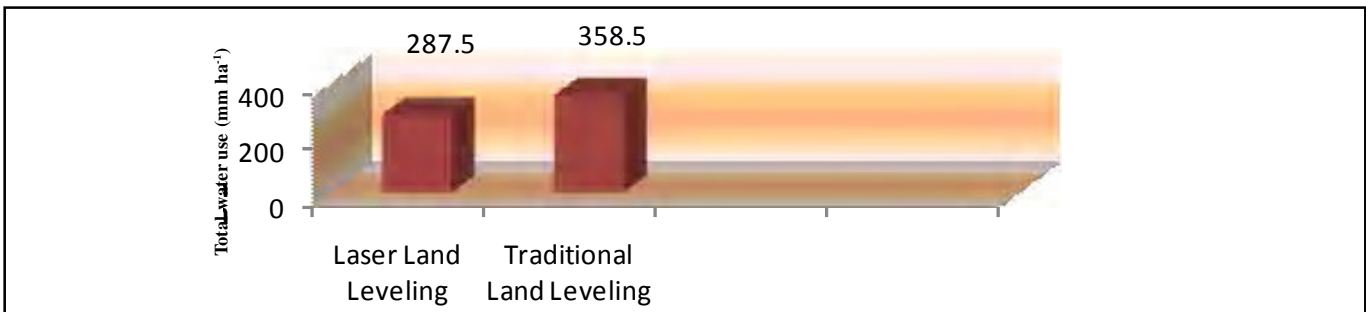


Fig. 2 : Effect of laser land leveling on total water use (mm ha⁻¹) in raised bed planted wheat

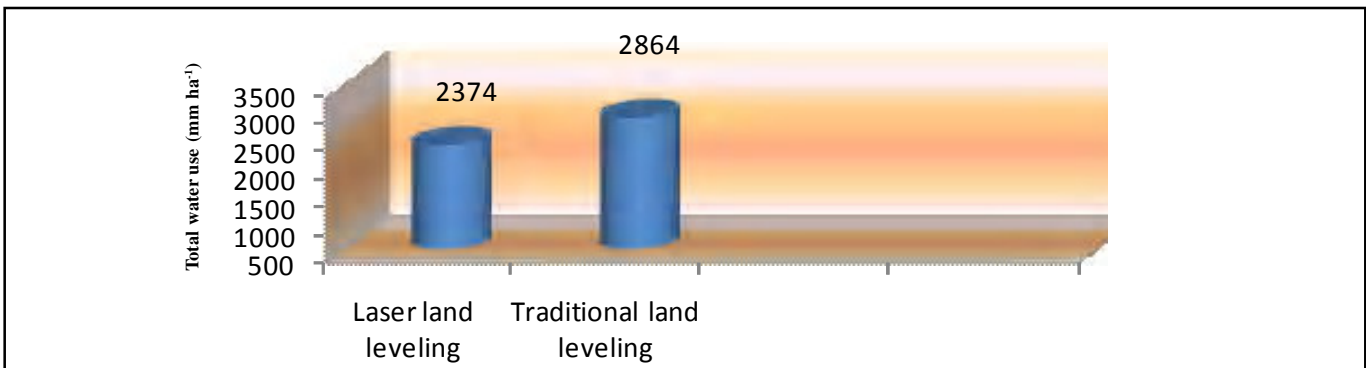


Fig. 3 : Effect of land leveling on total water use (mm ha⁻¹) of rice crop

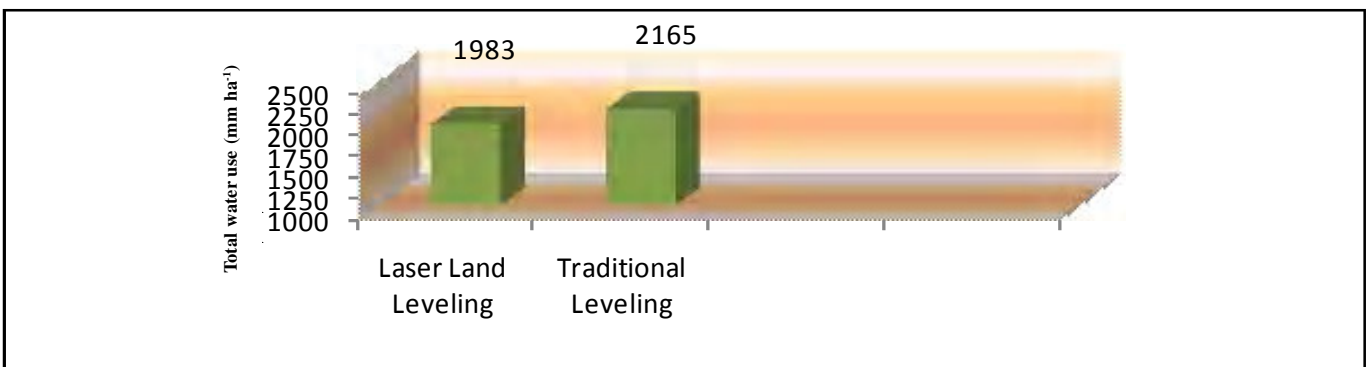


Fig. 4 : Effect of laser land leveling on total water use (mm ha⁻¹) in raised bed seeded rice

other related concerns by developing, evaluating, and refining various RCTs for the irrigated intensive cropping systems of the Western Uttar Pradesh of India. Recently, laser-assisted land leveling has shown promise for better crop establishment, water savings, energy savings, and higher farm profitability. Present study in the RW system Western Uttar Pradesh showed that laser land leveling increased farm income by Rs. 7250–15000 ha⁻¹ year⁻¹ through improving system productivity (7–20%) and saving irrigation water use by 9–20% in rice and by 10–25% in wheat. In addition, custom services on laser leveling provided employment for nearly 300 person-days year⁻¹ with net income of Rs. 3,21,370 per laser unit per year. Laser-assisted precision land leveling is a promising option to sustain irrigated intensive RW and other cropping systems on a long-term basis. Studies on the integration of precision land leveling with RCTs for evaluating their long-term impacts on yield, energy savings, groundwater table, groundwater pollution, and soil health are strongly recommended under different agro ecologies for their large-scale adoption. Laser assisted precision land leveling has been shown to improve water management, crop stand and productivity. With laser leveling, significant savings in irrigation water, improved efficiency of inputs, higher yields, increase in cultivated area, reduced cost of weeding and better operational efficiency can be achieved. Acceleration of laser land leveling technology and assessing its log-term impact needs immediate attention.

Authors' affiliations:

RAJ K. GUPTA, CIMMYT India Office, NASC Complex, Pusa, NEW DELHI, INDIA

ASHOK KUMAR, Department of Soil Science, Sardar Vallabhbhai Patel University of Agriculture and Technology, MEERUT (U.P.) INDIA

SATYA PRAKESH, Krishi Vigyan Kendra (S.V.B.P. Univ. of Ag. and Tech.), Baghra, MUZAFFARNAGAR (U.P.) INDIA

S.S. TOMAR AND ADESH SINGH, Department of Agronomy, Sardar Vallabhbhai Patel University of Agriculture and Technology, MEERUT (U.P.) INDIA

R.C. RATHI AND A.K. MISHRA, Krishi Vigyan Kendra (S.V.B.P. Univ. of Ag. and Tech.), SAHARANPUR (U.P.) INDIA

MADHVENDRA SINGH, Krishi Vigyan Kendra, GHAZIABAD (U.P.) INDIA

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