The Pharma Innovation Journal 2021; SP-10(4): 263-265

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; SP-10(4): 263-265
© 2021 TPI
www.thepharmajournal.com
Received: 15-01-2021
Accepted: 05-03-2021

Dinesh Kumar
Ph.D. Scholar, Department of Agricultural Economics, CCSHAU, Hisar, Haryana, India

Dalip Kumar Bishnoi
Assistant Scientist, Department of Agricultural Economics, CCSHAU, Hisar, Haryana, India

Vinod Kumar
M.Sc. Scholar, Department of International Agriculture Development, Hisar, Haryana, India

Ashok Godara
Associate Director, SNNIATTE, CCSHAU, Hisar, Haryana, India

Ajay Singh
Ph.D. Scholar, Department of Agricultural Economics, CCSHAU, Hisar, Haryana, India

Corresponding Author:
Vinod Kumar
M.Sc. Scholar, Department of International Agriculture Development, Hisar, Haryana, India

Comparative analysis of land levelling technology and conventional land levelling in cotton-wheat cropping pattern with respect to irrigation and water productivity in Haryana

Dinesh Kumar, Dalip Kumar Bishnoi, Vinod Kumar, Ashok Godara and Ajay Singh

Abstract
The study has evaluated impact of Laser land levelling technology (LLL) in conserving water, reducing effective irrigation hours and increasing water productivity in paddy-wheat and cotton-wheat belt of Haryana. Study highlighted that number of irrigations, average time per irrigation and total irrigation time per crop were significantly reduced due to adoption of laser land levelling over conventional land levelling. However, the effect was more prominent in paddy-wheat belt of Karnal than cotton-wheat belt of Sirsa. Main reason behind this finding was that paddy being more water thirsty crop and require waterlogged condition so it was impacted most by the technology. In paddy-wheat cropping system of karnal 5.32 and 62.67 hours per hectare were saved per irrigation and per season respectively similarly, in cotton-wheat cropping system of Sirsa 3.88 and 22.93 hours were saved per irrigation and per season respectively. Water productivity enhanced by LLL was 0.14 and 0.47 kg/cu.m in cotton and wheat respectively in Sirsa while 0.31 and 0.68 kg/cu.m in Paddy and Wheat in Karnal respectively. Therefore, on the basis of findings of the study it was strongly recommended to adopt this climate smart and resource conservation technology in order to cope up with rising demands of water pausing a serious threat on the survival of life.

Keywords: Water productivity, laser land levelling, water thirsty crop

Introduction
Water is the most precious resource on planet Earth. Around 70 per cent of earth is covered with water that's why it is named as blue planet but interestingly only less than 1% water is used for drinking and irrigation purpose and rest is saline water stored in big oceans and seas. About 62 per cent area of state is under poor quality of water. State is facing problems of declining as well as rising water tables, soil salinity/alkalinity (0.23 million ha), deteriorating soil health and stagnating crop productivity. Agriculture being largest beneficiary of ground water, declining ground water table will impact sustainability and food security. According to Ranjan Aneja, an economist in Central University of Haryana, the share of Haryana's districts that have depleted water reserves to "dangerous" levels has raised from 63 per cent in 1995 to 89 per cent in 2014. Ground water table is continuously shrinking in state due to over extraction of water to fed rice-wheat crop rotation. According to the central water commission's data, the average depth at which ground water was available in 1975 was 9.19 meter which plummeted to 18.66 meter in year 2016. Primary cause of decline in water table is practicing of water-hungry crops such as paddy-wheat crop rotation. Various studies were conducted and suggested that in Haryana, paddy-wheat crop rotation is unsustainable and is lowering the water table. The increased popularity of these crops may be attributed to remunerative prices for rice and wheat, not only for ensuring food security, but resulted in draining out the excess water brought about due to unlined canals and lack of adequate drainage in state. Cultivation of these crops over the years has brought significant decline in ground water levels and leading to overexploitation of ground water resources. As per the estimates of Central Ground Water Board (CGWB) carried out jointly with the state government revealed that annual replenish able ground water resources in the state is 9130.51 million cubic meter (MCM) against the withdrawal of 12500.38 million cubic meter, leading to exploitation of ground water. Kaur Baljinder (2012) [8] conducted a research in Moga district of Punjab to evaluate economic and environmental benefits of using laser land

levelling technology. Results of the study revealed that adoption of laser leveller saved water and energy by 24 per cent and increased yield of rice by 4.25 per cent. Irrigation cost was reduced up to 44 per cent and there was 39 per cent improvement in water productivity. Aryal *et al.* (2014) [3] tried to access impact of laser land levelling in rice-wheat cropping system of Northern India. Major outcomes of research revealed that laser land levelling reduced irrigation time in wheat and rice by 10-12 and 47-69 hours per hectare per season, respectively. Incremental productivity was observed due to use of laser land levelling (LLL) in rice-wheat was 7 per cent and 8.8 per cent, respectively. Study showed that laser land levelling (LLL) was a scale neutral technology. Also, it was experienced that due to reduction in irrigation time about 300 to 410 litres of diesel per hectare per year and 558 to 762 kilowatt hour of electricity per hectare per year was saved which ultimately decreased farmer's cost and environmental pollution. Laser land levelling provided annual USD 138 per hectare per year incremental benefits due to increased rice and wheat productivity. It was also estimated that even adopting laser land levelling (LLL) on 50 per cent of total area of Haryana and Punjab additional 987 million kg and 699 million kg of wheat and rice, respectively could be produced which could help in combating with food security issue.

Despite the critical problem of water crisis, farmers are continuously growing paddy, which requires 80 per cent more water compared to maize because electricity is provided at almost free of cost and farmers have minimum incentives to conserve it and hence it act as positive externality. In the 1960s, these types of subsidies, along with high yielding seeds and fertilizer had led to green revolution in India, whose benefits are now denigrating and dwindling continuously. So, resource conservation technology is need of hour and laser land levelling is ultimate technology to conserve most precious resource *i.e.* water.

Materials and methods

The study was carried out in Karnal and Sirsa districts of Haryana. These districts were purposively selected on the basis of highest area under paddy-wheat and cotton-wheat cropping pattern, respectively in Haryana. From each districts, two blocks were selected at random. Further, twenty (20) adopters and ten (10) non-adopters farmers of laser land levelling technology were taken randomly from each selected block. It means districts were selected through purposive sampling while farmers were selected through random sampling within each districts. Thus, a total of 120 sample farmers were interviewed for the investigation. Primary data regarding irrigation was collected from farmers through random sampling and with the aid of pretested interview schedule.

Water productivity was calculated by dividing yield by total irrigation water use. However, it was very difficult to calculate discharge rate. So, to calculate water productivity discharge rate of 10 Hp, 12.5 Hp, 15 Hp and 20 Hp electric pump was assumed as 12 litre per second, 15 litre per second, 18 litre per second and 22 litre per second as per engineering data. This was assumed to maintain uniformity otherwise it would have been very tedious to calculate discharge rate.

Water productivity= yield/water used (kg/Cu.m)

Irrigation analysis was on the basis of various criteria like reduction in number of irrigations, average time per irrigation, total irrigation time for the crop, irrigation duration for entire cropping system. So, comparison was made between crops and between cropping system too.

Results and discussion

Comparative analysis of irrigation water uses under different methods of levelling

Comparative analysis of irrigation water uses under different methods of levelling for cotton-wheat and paddy-wheat cropping system in Sirsa and Karnal districts of Haryana under various headings (Table 1).

In case of cotton crop average numbers of irrigation were 5.33 and 5.40 under laser land levelling and conventional land levelling, respectively. Reduction in duration of per irrigation and per crop season for cotton crop was recorded to be 1.78 hours and 10.33 hours, respectively under laser land levelling over conventional land levelling. While in case of wheat, average numbers of irrigation were 5.20 and 5.36 under laser land levelling and conventional land levelling, respectively. Reduction in duration of per irrigation and per crop season for wheat was estimated to be 2.10 hours and 12.60 hours respectively. Hence, in cotton-wheat cropping system, there is reduction of 3.88 hours and 22.93 hours for per irrigation and per crop season under laser land levelling over conventional land levelling in the Sirsa district of Haryana.

In case of paddy, average numbers of irrigation were obtained to be 10.60 and 9.20 under CLL and lll, respectively. Reductions in duration of per irrigation as well as per crop season were estimated to be 3.40 and 52.42 hours under laser land levelling over conventional land levelling. Similarly, in case of wheat in Karnal district, average numbers of irrigation were 4.30 and 4.10 under CLL and LLL respectively. Reductions in duration of per irrigation and per crop season were found to be 1.92 hours and 10.25 hours under lll over CLL. Hence, in paddy-wheat cropping pattern, reduction of 5.32 hours and 62.67 hours for per irrigation and per crop season, respectively were observed to be under lll as compared to CLL in Karnal district of Haryana.

Table 1: Comparative analysis of uses of irrigation water under different methods of levelling

Crop	Conventional levelling			Laser levelling			Difference	
	No of irrigations	Average time per irrigation (hr/ha)	Total irrigation time for crop (hr/ha)	No of irrigations	Average time per irrigation (hr/ha	Total irrigation time for crop (hr/ha	Diff in time per irrigation (hr/ha)	Diff. in time per crop season (hr/ha)
Cotton	5.40	11.98	64.70	5.33	10.20	54.37	1.78	10.33
Wheat	5.36	12.16	65.18	5.20	10.11	52.58	2.10	12.60
Total change in irrigation duration in cotton – wheat cropping system							3.88	22.93
Paddy	10.60	15.10	160.06	9.20	11.70	107.64	3.40	52.42
Wheat	4.30	11.9	51.17	4.10	9.98	40.92	1.92	10.25
Total change in irrigation duration in paddy – wheat cropping system							5.32	62.67

Water productivity of cotton-wheat and paddy-wheat cropping patterns in Sirsa and Karnal districts of Haryana

Water productivity of cotton-wheat under various methods of levelling in Sirsa district of Haryana was presented in Table 2. Results of the study revealed that water productivity of cotton under laser land levelling and conventional land levelling were estimated to be 0.75 and 0.61 kilogram per cubic meter (kg/cu.m), respectively indicated that with an improvement of 0.14 kg/cu.m in laser land levelling. While in case of wheat, it was calculated to be 2.02 kg/cu.m and 1.55 kg/cu.m, respectively under laser land levelling and conventional land levelling exhibited that an improvement of 0.47 kg/cu.m in laser land levelling over conventional land levelling in the study area.

Table 2: Water productivity of cotton-wheat under different methods of levelling in Sirsa district of Haryana

Sirsa	Cotton		Wheat	
	LLL	CLL	LLL	CLL
Yield(kg/ha)	1964.92	1909.85	5108.75	4858.53
Water use(cu.m/ha)	2609.76	3105.60	2523.84	3128.64
Water productivity(kg/cu.m)	0.75	0.61	2.02	1.55
Difference	**0.14**		**0.47**	

Cu.m. = cubic meter, kg = kilogram, ha = hectare

Water productivity of paddy-wheat cropping pattern in Karnal district of Haryana has been presented in Table 3. The results of the table indicated that under laser land levelling and conventional land levelling water productivity were estimated to be 0.86 and 0.55 kilogram per cubic meter (kg/cu.m), respectively, exhibited that an improvement of 0.31 kg/cu.m in laser land levelling over conventional and levelling. While in case of wheat it was found to be 2.87kg/cu.m and 2.19 kg/cu.m under laser land levelling and conventional land levelling, respectively with an improvement of 0.68 kg/cu.m water productivity in LLL over CLL in the study area.

Table 3: Water productivity of paddy-wheat under different methods of levelling in Karnal district of Haryana

Karnal	Paddy		Wheat	
	LLL	CLL	LLL	CLL
Yield(kg/ha)	4467.82	4254.09	5633.00	5371.99
Water use(cu.m/ha)	5166.72	7682.88	1964.16	2456.16
Water productivity(kg/cu.m)	0.86	0.55	2.87	2.19
Difference (kg/cu.m)	0.31		0.68	

Cu.m. = cubic meter, kg = kilogram, ha = hectare

Conclusions

Study validated resource conservation ability of laser land levelling technology and confirmed that irrigation is prerequisite for using laser land levelling. It was examined that irrigation hours were significantly reduced due to two reasons. Firstly, due to uniform slope application time was reduced significantly because there was no low lying areas where water could be accumulated and no raised regions to obstruct free flow of water. Secondly, due to pulverisation of soil by laser land levelling impervious layer was created which reduced percolation and infiltration losses. Water productivity was improved by two fold effect that is increase in yield (numerator) and decrease in water use (denominator). It was observed from study that it is possible for farmers to efficiently scarce resources that is irrigation and fertilizer by adopting and taping resource conserving potential of laser land levelling Technology on a wider scale and minimise the rising cost of cultivation. Therefore, the study suggested to adopt laser land levelling in order to conserve water in cotton –wheat as well as rice wheat cropping pattern in the study area.

References

1. Aggarwal R, Kaur S, Singh Amarjeet. Assessment of saving in water resources through precision land levelling in Punjab. Journal of Soil and Water Conservation 2010;9(3):182-185.
2. Ahmad B, Khokhar SB, Badar H. Economics of laser land levelling in district Faisalabad. Pakistan journal of applied sciences 2001;1(3):409-412.
3. Aryal JP, Bhatia M, Jat ML, Sidhu HS. Impacts of laser land levelling in rice-wheat rotations of the North-western Indo-Gangetic Plains of India. In World Congress of Environmental and Resource Economists, Istanbul, Turkey 2014.
4. Bhatt R, Sharma M. Laser leveller for precision land levelling for judicious use of water in Punjab. Extension Bulletin 2009.
5. Conservation agriculture. “Conservation Agriculture: Resource productivity and efficiency”, IV World Congress on Conservation Agriculture, New Delhi, PACA, Ist Floor, NASC Complex, DPS Marg, Pusa, New Delhi - 110012 India, 2009. Available: www.conserveagri.org, 2009.
6. Jat ML, Gupta R, Saharawat YS, Khosla R. Layering precision land levelling and furrow irrigated raised bed planting: Productivity and input use efficiency of irrigated bread wheat in Indo-Gangetic Plains. American Journal of Plant Sciences 2011;2(04):578.
7. Kaur B, Singh S, Garg BR, Singh JM, Singh J. Enhancing water productivity through on-farm resource conservation technology in Punjab agriculture. Agricultural Economics Research Review 2012;25:79-85.
8. Naresh RK, Rathore RS, Parvinder K, Singh SP, Adesh S, Shahi UP. Effect of precision land leveling and permanent raised bed planting on soil properties, input use efficiency, productivity and profitability under maize (*Zea mays*)-wheat (*Triticum aestivum*) cropping system. Indian Journal of Agricultural Sciences 2014a;84(6):725-732.
9. Thakar S, Gill MS, Sidhu HS, Sukhpreet S, Sidhu AS. (Effect of laser land levelling on water productivity and yield of rice-wheat cropping system. Indian Journal of Ecology 2009;36(1):95-97.