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A Pragmatical Approach on the Rice Fields Demonstrating Increase in Yield and Water Saving by Using Micro Irrigation Technology

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Abstract

The future of rice production which consumes a lion's share of water (85%) used in irrigated agriculture will therefore depend heavily on developing and adopting technologies and practices which will use less water with highest use efficiency. Rice is cultivated usually in a puddle condition with large volumes of water and grown in standing water.

The paper mainly discusses, the experimental trial is an effort to commercialise a package of micro irrigation technology for growing rice. A Pilot Project for "**Installation of Community Based Solar/Grid Powered Micro Irrigation Infrastructure in existing canal commands in various districts of Haryana"** was prepared by the Command Area Development Authority (CADA), Haryana to boost the reach of Micro Irrigation technologies among the farmers. Accordingly a demonstration plot of Rice crop on experimental basis has sown to motivate the farmers towards Micro Irrigation Technology. Irrigation was done in one acre through conventional flood and in two acres with micro irrigation systems. Appreciable results were obtained as yield was increased by 11.65 % in drip irrigation by saving of water which amounts to 42.03%.

Keywords: Paddy, Yield, Solar/Grid, Command Area, Micro Irrigation, Irrigation Efficiency, Saving Water

INTRODUCTION:

The problem of growing groundwater scarcity and persistent groundwater resource degradation can only be tackled by two folds in India. The first is the supply side management practices like water resources development through major, medium and minor irrigation projects, etc. The second is through the demand management by efficient use of the available water. This includes micro irrigation and other improved water management practices. The micro irrigation in general and drip irrigation in particular has received considerable attention from policy makers, researchers, economists etc. for its perceived ability to contribute significantly to groundwater and surface water resources development, agricultural productivity, economic growth, and environmental sustainability. In this paper, the impact of drip irrigation in rice has been studied on farming system in Haryana. The drip method of irrigation has been found to have a significant impact on resources saving, cost of cultivation, yield of crops and farm profitability. Now it is becoming the common policy agenda particularly in India being a developing economy. Rice is the main grain that is in demand in India and South Asian countries. Although conventional total water requirement is 1200–1400 mm per season according to the literature, but in practice, farmers use much more water (up to 2000 mm) in many areas rice fields either transplanting or direct seeding are always flooded with 5-10 cm of water throughout the growing season.

THE CHALLENGE:

- Reduce the high release of greenhouse gases (CH4 and CO2) due to rice flood irrigation – higher values than any other crop.
- Reduce leaching of flood water with high nitrogen concentrations, which causes ground water pollution.
- Use Drip irrigation for applying water, fertilizer and crop-protection chemicals in order to exterminate weeds without manual labour.
- Reduce the high levels of heavy metals absorbed from the soil and accumulated into the seed in anaerobic condition.
- Present a drip system showing that rice can be grown in all types of soil and topographies

DEMONSTRATION PLOT:

Although Micro irrigation technology for rice production was being demonstrated in farmers' fields since 2009 where irrigation systems were installed by the companies and operated by farmers but here in this case after providing necessary training on operation and maintenance to the farmers regular monitoring was done by Command Area Development Authority Haryana, Agronomist of Jain Irrigation system ltd., Scientists and farmers of nearby area till harvesting. This on farm trial was conduct on VAR–PR 126 in the fields of Sardar Karanjeet Singh of village Gumthala Garhu (Dera Fateh Singh)district Kurukshetra, Haryana.

COST OF CULTIVATION /ACRE:

		Transplanted Micro Irrigation	Transplanted Flood
A			
1-	Land Preparation	2000	2000
2-	Transplanting cost	2200	2200
3-	Fertilizers cost (dose/acre)		
	a- Urea 100 kg(Rs. 5.90/kg)	590	590
	b- SSP 150 kg (Rs. 7/kg)	1050	1050
	c- MOP 25kg(Rs.10.8/kg)	270	270
	d- Zink 10 kg(Rs. 30/kg)	300	300
4-	Seed + seed treatment	800	800
5-	Weedicide (Butachlor) Pre-emergence	300	300
6-	Insecticide/fungicide	2370	2370
	TOTAL(A)	**9880**	**9880**
B			
7- Total cost of Drip/Sprinkler system		50000	
8- Subsidy given to the farmer(1Acre) 85% of total cost		42500	
9- farmer share		7500	
10- Cost of Drip/Sprinkler system for 7 year(2crop/year) @ Rs.		535	
11- Total cost(Crop+Drip/Sprinkler cost of one season A+B) Rs.		**10415**	**9880**

METHODOLOGY:

Field experiment was conducted using PR 126 variety of rice. Two irrigation systems Micro Irrigation and traditional flood were used. Drip Irrigation was done through pressurised pipe system after passing the water through designed filters connected by 15 hp submersible motor installed in community water storage tank. Further from the sub-mains, in-line 16mm laterals were laid at a spacing of 40 cm and emitters of size 0.6 mm with 2.4 litre per hour discharge. Flood irrigation was maintained at 5.0 cm water depth. The total rain received during cropping period was 363 mm and effective rainfall is 192 mm as shown in figure –I

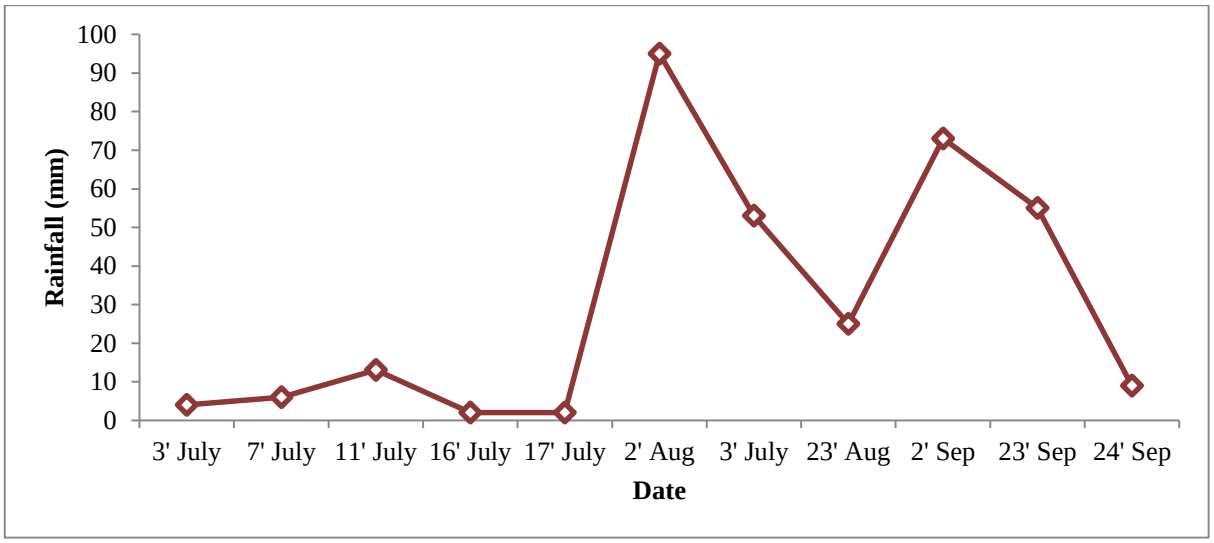

Figure - I

Table I. Fertigation schedule followed for experimental transplanted rice under drip and sprinkler irrigation method

Schedule of Fertigation	Urea (kg)	SSP (kg)	MOP(kg)	Zn (kg)	Fertilizer rate per day
Basal (soil application)	0	150	0	10	3.5 kg urea/day
10-20 DAT (Fertigation)	35	0	0		2.08 kg urea/day
21-40 DAT (Fertigation)	52	0	0		650 gram urea/day
41-60 DAT (Fertigation)	13	0	15		750 gram urea/day
61-80 DAT (Fertigation)	0	0	10		500 gram urea/day

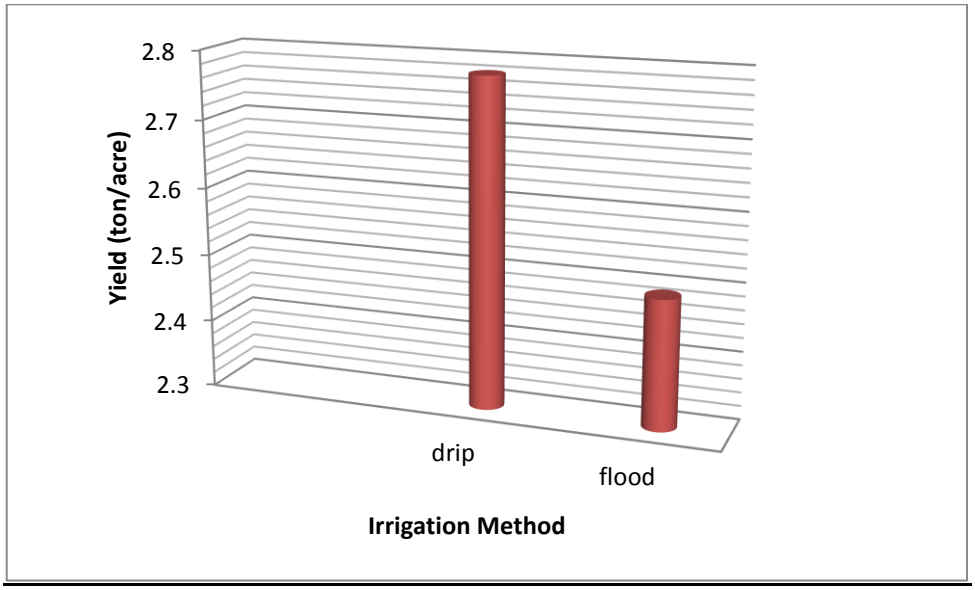

Figure – II

Table-II shows that use of water in flood irrigation and in Micro Irrigation system

Description	Micro Irrigation	Flood Irrigation	Benefit
Cost of cultivation	10415	9880	-
Yield	2.78 ton/acre	2.49 ton/acre	0.29ton/acre
Water Savings	2400000/1.94 AF	4140000/3.35 AF	42.02%
Net Income	33787	29711	4076

AGRONOMY PRACTICES:

The urea as nitrogen and muriate of potash (MOP) as potash source of fertilizers were applied through fertigation under micro irrigation systems whereas Single Super Phosphate (SSP) and Zinc fertilizers were applied through soil application during the sowing time. In flood irrigation method, all fertilizers had been applied by broadcasting; in which, half dose of N, full dose of P and K fertilizers were applied through basal application and remaining half dose of N fertilizers applied through top dressing. (Table –I)

RESULTS:

Rice yields under transplanted rice in flood & Micro Irrigation systems are 2.4 qtl & 2.78 qtl respectively. As shown in Fig. 2, each irrigation method has different rice yields. The drip irrigation method resulted in a higher yield than flood method. Drip irrigation produced 11.65% more yield as compared to flood irrigation. Table-II shows that use of water in flood irrigation is 4140000 litre and in Micro Irrigation system is 2400000 litre. Appreciable saving of water i.e. 42.03% has been noticed.

MONETARY BENEFITS:

The drip system has been found more profitable than flood irrigation due to higher yield. Higher net return (Rs.33787 per acre) was obtained under drip irrigation in comparison to flood irrigation (Rs. 29711 per acre). It shows that drip irrigation produced 13.71% more net income than flood irrigation method. (Table-III)

Table III. Economic and monetary benefits of rice cultivation with micro irrigation systems over conventional system

Details	**Transplanted Drip**	**Transplanted Flood**
Total cost of drip system (Rs.)	50000	-
Subsidy given to the farmer (one acre) 85% of total cost (Rs.)	42500	-
Farmers share (Rs.)	7500	-
Cost of drip system for 7 year (2 crops/year) @ Rs.	535	-
Gross income/acre (Selling price @ Rs. 15900/ton)	44202	39591
Net income/acre	33787	29711
Incremental yield in drip/acre (in t)	0.29	-
Net incremental income (Rs.)	4511	-

ENVIRONMENTAL ISSUES:

Emission of methane gas in rice ecologies is a major environmental issue; one of the factors, resulting in methane emission from rice fields is the standing water and the anaerobic decomposition of organic matter. In the non-flooded situation like drip irrigated rice the conditions for methane formation would be minimal. Similarly fertigation—application of fertilizer as a dilute solution in multiple doses for rice crop—would also bring down nitrate pollution into community water bodies.

CONCLUSION

It was common belief that water-saving irrigation techniques often run the risk of yield reduction because of possible drought-stress on the crop. On this demonstration plot, it has been proved pragmatically beyond doubt that for cultivating rice in water-limited condition and by following advanced water saving techniques such as drip irrigation system has assured to sustain the productivity under water scarce situation. There is huge saving of water up to 42.03% to tackle the issue of overexploited blocks and increase yield by 11.65% which is establishing that water can be reduced without compromising the yield even in rice production.

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