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Research Article

Micro Irrigation System a Viable Alternate in Paddy Cultivation with Pressurised Supply of Canal Water through Solar/ Grid Powered Infrastructure in Haryana

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A B S T R A C T

Being the most critical input about 85% for agriculture, judicious use of water is important to ensure sustainable agriculture developmentwhich could only be achieved with Mantra "Per Drop More Crop". In Haryana arable lands are being irrigated through tertiary Canals i.e. brick lined open water courses/field channels with quite low water use efficiency. Now, State is in process of paradigm policy shift to provide water distribution system capable of installing Micro Irrigation Systems. This can be accomplished by integrated approach in water management by increasing the available supply with reduction in conveyance losses and by increasing the field application efficiency with use of Micro Irrigation Systems. This purpose has been served by installing community based Solar/Grid Powered Micro Irrigation infrastructure System in the Canal Commands to boost the reach of Micro Irrigation technologies among the farmers. The Solar Power System is proposed to be connected with the utility power grid through bidirectional meter. Micro Irrigation potential has been established in Rice Crop on experimental basis in which appreciable results were obtained as yield was increased by 11.65% in drip irrigation by saving 42.03% water.

Keywords: Solar/Grid, Micro Irrigation, Canal Command, Irrigation Efficiency, Paddy, Yield

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.

Methodology

Solar/ Grid Powered Micro Irrigation Infrastructure in the Canal Commands has been installed by providing Community based water storage tank near outlet head, Pumping Unit (Grid/ Solar Powered), Filtration units, HDPE pipe network/ Hydrant/ Outlet assembly, Valves etc. in the command area of canal outlet, as shown in layout plan (Figure 1). Drip/ Sprinkler irrigation sets will be installed by the individual farmers in their farm holdings by availing the benefits of subsidy. It is proposed to take water from canal outlet through underground pipeline with gravity and to store the same in the tank of appropriate size for construction of which the land shall be made available by the WUA of the shareholders of the canal outlet. Solar/ Grid powered pumping system connected through net metering has been installed nearby the tank with proper filtration systems to avoid any chocking. Water has been carried to entire area of the chak of the outlet through HDPE pipe line network under pressure. The entire pipe network has been buried under ground at 3 feet deep to avoid land acquisition. Water with the requisite pressure for running of the drip/ sprinkler set has been made available to each shareholder at his farm holding through the common infrastructure to be operated & maintained by the Water User's Associations.

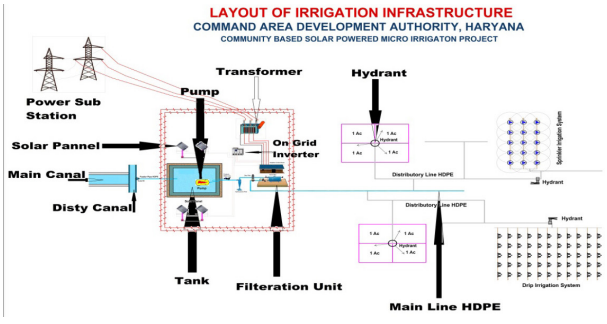

Figure 1.Layout Plan

Design Parameters

Modified penman method has been used to find out crop water requirement and computed the peak water requirement in rabi and kharif season. In this scheme average water requirement of 2mm/ day has been considered. Design of this scheme is based on actual Culturable Command Area (CCA), approved discharge normally 2.4 cusecs/000 acres and schedule of running of canal outlet by collecting the authenticated data from the Canal Authorities. Each component of this scheme shall be designed in such a manner that minimum operating pressure of 2.5Kg/cm2 available to the farmers on their farm gate. Size of the storage tank has been designed by considering discharge of the outlet and volume of water accumulated in 24 hours. A feeder pipe of required size in appropriate length has been provided from canal outlet to the storage tank by gravitational flow. Solar pumping system is a vital part of this scheme and in this scheme grid connected solar powered pump has been considered to reduce the cost of electricity of appropriate size. At least one pump is provided in a block of area 40 to 50 Hectare. Solar pumps of the capacity up to 10-20HP is preferred with average working of 14 hours/day. The HP of pump set required is based upon design discharge and total operating head. The total operating head is sum of total static head, friction loses worked out with hazen-williams equation in pipeline network and losses in filtration unit. Pipes in main line and sub-main shall not be below 110 mm (OD) and the size shall be decided based on the criteria to limit the friction loss in the main and sub main keeping the minimum flow velocity in the pipeline as 0.6m/sec.

HP of pump set = QxH.
75e
Q = discharge (in LPS)
H = head (in meter)
e = Pumping efficiency

Solar PV array of at least 1100 wp capacities has been installed per HP rating of pumping sets and total capacity of the Solar pv array for operation of solar pumping sets has been worked out in such a manner that total annual solar energy generation from the PV power system in no case be lesser than the total energy requirement to run the Micro Irrigation System and there is no net import of energy from the utility grid on annual basis. For working out the total annual energy requirement of the Micro Irrigation System likely days of running of canal outlet in a year has been considered based on the actual schedule of canal running, but total running days of the canal in year shall not be any case be less than 180.

The output power of SPV would be fed to the inverters for conversion of the DC produced by SPV array to AC for operation of the motor pump sets and feeding the same into the nearest electricity grid through 11KV, 24 hours energised HT independent line after synchronisation when in excess of requirement. A hydrant assembly has been provided with minimum 110 size for the land holding of

every share holder with provision of at least one hydrant for every 04 acres or less.

Demonstration Plot

Despite the fact farmers across Haryana are well aware of the situation of ground water which is principal source of water for irrigation is running out however indiscriminate use of ground water for the water guzzling paddy crop is going on. According to the analysis of agriculture experts, 3000 to 4000 liters of water is required to produce 1 kg of rice which is a major crop in Haryana. State Government has tried best to motivate farmers towards diversification of crop instead of paddy but farmers are adamant and area under paddy grew manifold within few years. Now even in the districts, where drinking water is also a serious problem, farmers are growing paddy crop. Taking in to the account of the merciless use of water in paddy a demonstration plot of Paddy crop on experimental basis had been set up in paddy bowl District Kurukshetra in village Dera Fateh Singh (Gumthla Garu) to motivate the farmers towards Micro Irrigation Technology. Irrigation was done in one acre through flood irrigation and in two acres with micro irrigation. 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 SardarKaranjeet Singh of village GumthalaGarhu (DeraFateh Singh)district Kurukshetra, Haryana.

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.

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-2).

Table 1.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(1 Acre) 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

Table 2.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

Results

Rice yields under transplanted rice in flood & Micro Irrigation systems are 2.4 qtl & 2.78 qtl respectively. 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.

Table 3.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

Conclusion

Significant irrigation from tube wells are being done in various districts of Haryana. Canal water use efficiency is very poor and ground water wastage in shape of flood irrigation is being over exploited. It also causes wastage of electricity. Use of micro irrigation infrastructure will reduce the use of tube wells by which ground water will be saved. More area can be brought under canal command, which was otherwise either rain fed or irrigated by tube wells. Hence, by installation of Solar/ Grid Powered Micro Irrigation Infrastructure in the Canal Commands through integrated approach of supply management and demand management, yield & net sown area will increase, dependency of tube well & overexploitation of ground water will decrease, saving of highly subsidised electricity and above all change of the mindset of the farmers towards the use of available water judiciously. 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.

References

1. Saulter R, Watson J. Stratigies for the deployment of micro generation: Implications for social acceptance.
2. Batchelor C, Lovell C, Murata. Water user Efficiency of Simple Subsurface Irrigation Systems. 7th International Conference on Water and Irrigation. 1996.
3. Bhamoriya V, Mathew S. An Analysis of Resource Conservation Technology: A Case of Micro-Irrigation System (Drip Irrigation), Centre for Management in Agriculture Indian Institute of Management, Ahmedabad. 2014.
4. New Paradigms of Growing Rice to Address Emerging Shortage of Water and Labor: JK Ladha, IRRI, New Delhi.
5. Drip Irrigation from Rice Cultivation: Jain's Experiences.
6. Drip Irrigation in Paddy in Punjab, India: Exploring The New Horizons for Sustainable Agriculture: RakeshSharda, PAU, Ludhiana, Punjab.
7. Drip Irrigation and Fertigation in Direct Seeded Aerobic Rice in Karnataka, India-Research Status: Nagaraju, UAS, Banglaore.