Contents list available at Science Letters

Science Letters

journal homepage: http://www.scienceletters.org/

Technologies for Horticultural Development through Solar Drip irrigation to improve options for farmers for better production of Agriculture Crops

Himanshu Behera[1], Madhusmita Behera[1], Anuz Pravat Minz[1], Sadashib Rout[1], Pranati Mishra[2], and Babita Kumari[3*]

[1]*Department of Civil Engineering, Sophitorium Engineering College, Khurdha, Odisha-752060, India*
[2]*Center in Science and Technology Customization for Tribal Developments, Jatni, Khurda, Odisha-752060, India*
[3]*Department of Biotechnology, Sophitorium Institute of Technology and Life Skills, Khurdha, Odisha-752060, India*

ARTICLE INFO

Article History
Received 02 April 2021
Revised 14 June 2021
Accepted 16 June 2021
Available Online 17 June 2021

Keywords:
Solar,
Drip Irrigation,
Photovoltaic,
Rain-fed Irrigation,
Solar pumps,
Solar Panels,
Solar Irrigation

ABSTRACT

The Suppliers of Solar drip irrigation system increasingly optimizing the whole system, including solar generator, pump, controller and accessories, plus the irrigation system. Additionally, suppliers now often provide technical support services to satisfy the needs of end users. Solar-powered irrigation has the potential to increase incomes dramatically, particularly for the most remote producers. Combining drip irrigation kits, newly affordable photovoltaic panels and off-the-shelf, 12-volt pumps can result in a cost-effective system for supplying water for irrigation. Solar-powered irrigation has the potential to increase incomes dramatically, particularly for the most remote producers. Another trend goes in the opposite direction: individual components – PV panels, standard irrigation pumps and available controllers – are offered on the market and integrators provide services to connect these components into one irrigation system.. Besides, solar drip irrigation has a great impact on agriculture can be a high-risk venture, particularly with changing rainfall patterns and high-value crops such as fruits and vegetables. Irrigated cropland is twice as productive as rain-fed agriculture, but many farmers do not have access to irrigation infrastructure, including a nearby water source and power to move the water to and through their fields. Rain-fed agriculture can be a high-risk venture, particularly with changing rainfall patterns and high-value crops such as fruits and vegetables. Irrigated cropland is twice as productive as rain-fed agriculture but many farmers do not have access to irrigation infrastructure, including a nearby water source and power to move the water to and through their fields. Combining drip irrigation kits, newly affordable photovoltaic panels and off-the-shelf, 12-volt pumps can result in a cost-effective system for supplying water for irrigation. The objective of this study was to review a comprehensive study on future impact of solar drip irrigation.

1. Introduction

Solar drip irrigation has been around for several decades. Solar pumping systems are continuously evolving and improving, including configurations with drip irrigation, floating solar panels or purely solar-driven centre-pivot irrigation machines. Prices have gone down significantly now and solar-powered irrigation technologies have become a reliable and viable option for many farmers, providing affordable energy and thus renewable energy costs for irrigation (Purohit *et al*., 2008) (Figure 1).

Their design requires not only a fit-for-purpose PV pump system and irrigation infrastructure (supply side), but also an assessment of water requirements and irrigation calendar (demand side) as well as skills and knowledge of the end user (Firatoglu *et al*., 2012, Phuangpornpitak *et al.,* 2007, Joseph 1985). Moreover, online technologies will further improve SPIS and make it more versatile. Monitoring (e.g. groundwater), remote control and extended communication platforms can be expected to be part of even small-scale applications at minimal extra cost (Awady *et al.,* 2002., Baqui *et al.,* 1994, Sharma *et al.,* 2009). In India, water shortage is a big challenge along with water wastage

*Corresponding Author: Babita Kumari
E-mail Address: bbtmshr@yahoo.co.in
DOI: 10.46890/SL.2020.v02i06003

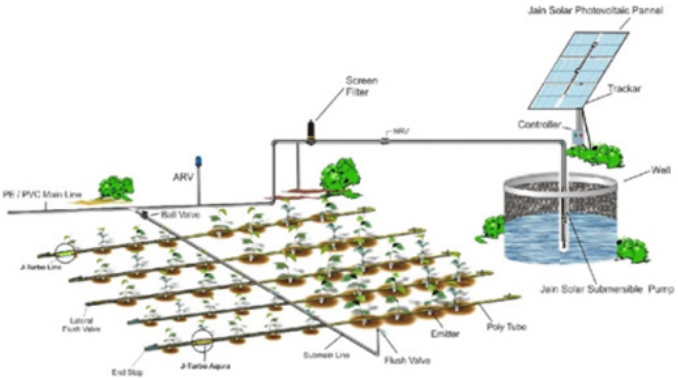

Figure 1: Showing the schematic design of Solar Drip Irrigation.to ruin the field of Agriculture crops.

through inefficient irrigation system, which ultimately leads less crop water productivity (Kim and Evans, 2009). The pressurized irrigation system (drip irrigation system) is one of the options to get the high water use efficiency and to get more crops per drop. . The excessive load shedding in rural areas has also dropped down the yield of the crops per year. Power experts suggested that there might be more energy crises in the country in next two years (Faheem and Mir, 2009). Solar Drip irrigation users need an alternate to traditional energy possibility, which may be solar, wind, bio-mass, hydral and geothermal sources. Solar energy (photovoltaic) is one of the major focuses as a renewable energy source in the world.

Solar Drip irrigation is a remarkable water technology, established about two decades ago (Shyamaa *et al.,* 2009; Kang *et al.,* 2000). Possibilities exist for unused electricity (when pumping is not required) to be fed into the electricity grid or to be used for other on-farm productive applications, further increasing the economic viability of SPIS. However, this requires more research and development as well as specific policy and governance decisions to support such multiple use applications.

Average annual rainfall is less than the total crop water requirement, so surface water is not enough to fulfill the requirements in agriculture sector. To overcome water shortage more than one million tube wells have been installed in the country, out of which 83% are diesel operated and remaining by electricity (Qureshi *et al*., 2011). The increasing prices of petroleum and current breakdown of electricity is the main dispute to adopt efficient irrigation system in India. The shortfall of electricity in the Pakistan, in May-2011 was near about 7000mega-watt (MW) reported by the Pakistan Electric Power Company. Pakistan is an agriculture based country and its rural areas are in severe electricity shortfall. The main use of electricity is to pump water for the agriculture use and there is unscheduled load shedding in the rural areas, which has totally turned down its agriculture system.

In solar drip irrigation system, soil moisture is maintained around the plants in growing period, which results in an increase in production and growth because the plants are not under wet or dry stress as in other irrigation methods. With the help of this technology, serious problem related to water has been resolved, and additionally it improved the farm output by increasing income and reducing cost (Bisconer, 2008; Dursun and Ozden, 2012). Photovoltaic (PV) is a technique in which sun energy is directly converted to the electric power with the PV cells. A set of cells in form of PV Panels are reliable energy source with about 20-25 years life span in all weather conditions.

Beneficial Aspects of Solar Drip Irrigation

1. The use of solar irrigation can increase incomes dramatically, particularly for remote producers with inconsistent access to electricity or fuel

2. The regular Pump irrigation can reduces labor for water delivery

3. The targeting of water irrigation at a crop's roots, drip irrigation can reduce weed and disease pressures, and increase efficiency of chemical applications

4. Besides above, Drip irrigation significantly increases water use efficiency

Basic Particulars to set up Solar Drip Irrigation

1. Solar panels and frame
2. 12V water pump and electric wire
3. Water level switches
4. PVC piping, connectors, valve
5. 500L water storage tank and stand
6. Filters
7. PVC cutter
8. Irrigation tape or tubing

Motivational and Income generating source to Scaling up Solar Drip Irrigation

1. **Education:** To provide training through the Horticulture Innovation Lab Regional Centers and our network of partners.

2. **Research:** To Testify the components available in partner countries to find the most effective and affordable combinations.

3. **Partnerships:** The regular work with the Horticulture Innovation Lab's network of partners play a significant role to provide training, consulting and extension services to small-scale fruit and vegetable growers.

Role of Solar Drip Irrigation our good s to be good source of income to strengthen the life of poor farmers

1. Solar irrigation can increase incomes dramatically, particularly for remote producers with inconsistent access to electricity or fuel.

2. Pump irrigation reduces labor for water delivery.

3. By targeting water at a crop's roots, drip irrigation can reduce weed and disease pressures, and increase efficiency of chemical applications.

4. Drip irrigation significantly increases water use efficiency.

Future Prospects

A global overview and systems were not compatible. bringing manufacturers, planners and users together in an association helped to promote the sector, to develop it further and to standardize and control the quality of equipment. A neutral effort and financing to support the integration of these technologies – i.e. without company bias – is urgently needed. Irrigation monitoring the amount of irrigation water on the field will have to be monitored more precisely and regularly. As water becomes less available, this aspect will play an ever more important role. Weather stations Weather stations are becoming more important for an optimized irrigation regime and schedule. These stations can be expanded to become service centers for agricultural crop production as well Future trends Planning software Well-designed and easy-to-use software is available for solar pumping systems as well as for certain irrigation technologies. This will be possible if their databases are expanded to provide not only weather data, but also soil data, such as soil moisture, for the most important crops of the region. Forecasting for the upcoming few days could be made available, so that farmers know how much irrigation water has to be provided for each field and crop. This will require a closely linked network of extended weather stations. However, the integration of technology for solar pumps and irrigation is needed and is expected to be available in the future. For this purpose, a differentiation should be made between monitoring water applied, which can be easily measured in pressurized systems with flow meters, and water transpired, which can be assessed through remote sensing technologies measuring evapotranspiration and biomass production. Modern technologies will become increasingly common – for example, monitoring of irrigated fields with drones and thermal imaging cameras. Satellite and thermal imagery is already used to calculate irrigation water demand (and to measure actual supply) for defined areas.

Conclusion

Hence, the principal of solar powered intelligent drip irrigation system is significantly based on control module with sensor data availability to the irrigation system on the difference of threshold limit of soil moisture content of the irrigated crops, and real-time soil moisture content. When the soil moisture content of the crop is below the permissible limit, the sensors will message to control system and irrigation system to start the until the soil moisture content reaches the limit. It is the cheapest method can be acceptable easily for farmers to ruin their better livelihood.

Acknowledgement

The authors want to give heartfelt thanks to Department of Science and Technology for providing financial support. Special thanks also go to Sophitorium Group of Institution for providing Land and needful Solar Drip Irrigation resources.

References

[1] M.N. Awady, M.F.A. Sallam and A.M. Hegazi. Performance of solar- powered drip-irrigation system. *Misr. J. Agri. Eng*. 2002, 19: 297-312.

[2] M. A. Baqui, and L.A. Honorato.. Construction, Operation and test of a Bamboo Drip Irrigation system. *J. AMA* 1994, 25: 41-44.

[3] I. Bisconer. A study to Maximize drip irrigation benefits by it automating. *Toro Micro-Irrigation Business*. 2008, 2(1):172-187.

[4] M. Dursun and S. Ozden. Application of Solar Powered Automatic Water Pumping in Turkey. *Int. J. Computer and Electrical Eng*. 2012, 4: 161-164.

[5] S. A. Faheem. and A.T. Mir. Energize Pakistan, Report for 'Explore-a-Vision' Competition, GIKI-IEEE Olympiad 2009. National University of Computer & Emerging Sciences, FAST (Karachi):2009, 1-14.

[6] Z. Firatoglu, and B. Yesilata. New approaches on the optimization of directly coupled PV pumping systems. *Solar Energy* 2004, 77: 81–93.

[7] St. Joseph. Emitter Uniformity as an economic factor Trickle System Design. *American Society of Agricultural and Biological Engineers*, 1985, 28: 826-831.

[8] S. Kang, W. Shi and J. Zhang.. An improved water use efficiency for maize grown under regulated deficit irrigation. *Field Crops Res.* 2000, 67: 207-214.

[9] Y. Kim, and R.G. Evans. Software design for wireless sensor-based Site-specific irrigation. *Computers and Electronics in Agriculture* 2009, 66: 159-165.

[10] N. Phuangpornpitak and S. Kumar.. PV hybrid systems for rural electrification in Thailand. *Renewable and Sustainable Energy Reviews* 2007, 11:1530-1543.

[11] P. Purohit and A. Michaelowa.. CDM potential of SPV pumps in India. *Renewable and Sustainable Energy Reviews* 2008, 12:181-199.

[12] L. Qureshi, B.K. Lashari, S.M. Kori and G.A Lashari. Hydro-salinity behavior of shallow groundwater Aquifer underlain by salty groundwater in sindh Pakistan. Fifteenth International Water Technology Conference, IWTC-15, Alexandria, Egypt 2011.

[13] R. K. Sharma and T.K. Sharma. Irrigation Engineering (Including Hydrology). Published by S. Chand & Company Ltd., New Dehli.2008, pp. 1-731.