



International Journal of Plant Pathology and Microbiology

E-ISSN: 2789-3073
P-ISSN: 2789-3065
IJPPM 2022; 2(2): 25-29
Received: 10-05-2022
Accepted: 12-06-2022

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Impact of solar pump set on change in the cropping pattern and cropping intensity of Bilaspur district of Chhattisgarh

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Abstract

Agriculture is important to the Indian economy. Agriculture supports more than 70 per cent of rural households. The share of agriculture and allied sectors in Gross Value Added (GVA) of the country at current prices is 17.8 percent for the year 2019-20. Chhattisgarh holds first position in India for installing the maximum number of solar pump set. The study was conducted in Bilaspur district of Chhattisgarh and found that before using solar irrigation pump by the farmers were cultivating paddy and pigeon pea in Kharif season. Paddy, wheat, Lathyrus, coriander and also chickpea were grown in during Rabi season after that land was left fallow in summer season. The net cropped area was 2.14 hectare, gross cropped area was 2.98 hectare and cropping intensity was 138.78 percent. After using a solar irrigation pump the farmers were changed their cropping patterns and increased gross cultivated area. The farmers were grown some additional crops like chilli, brinjal and papaya in kharif season, tomato in Rabi season and okra, blackgram and mung bean in summer season. Hence, the gross cropped area was increased 4.36 hectare and cropping intensity was 203.73 percent after adopting solar irrigation pump.

Keywords: Solar pump, cropping pattern and cropping intensity

Introduction

Agriculture is important to the Indian economy. Agriculture supports more than 70 per cent of rural households. The share of agriculture and allied sectors in Gross Value Added (GVA) of the country at current prices is 17.8 percent for the year 2019-20 and provides employment to over 60 percent of the population (economic survey 2020-21).

India's total geographical area is 329 million hectares. Out of this, 198.5 million hectare is gross cropped area and 141 million hectare is net sown area. The net sown area works out to be 43 percent of the total geographical area. While 48.5 percent (68.4 million hectare) of the 141 million sown hectares depend on irrigation, the rest relies on the monsoon. (Reddy 2021) [14]. Irrigation is a critical input for agricultural production and plays an important role in food security but in today's time, most of the electricity and diesel used in agricultural work is being used in irrigation pumps, which will emerge as a big problem for the coming time. The use of solar pump set is the option to overcome this problem in future.

The total geographical area of Chhattisgarh state is about 138 lakh hectare out of which 46.51 lakh hectares is net sown area, presently about 14.76 lakh hectare areas is net irrigated area of the state which is about 32% of total sown area. (Directorate of Agriculture, Chhattisgarh-2021) [1]

Currently, India is almost entirely reliant on electric and diesel pumps of the nearly 30 million irrigation pumps in use throughout the country, about 70 percent run on grid electricity, 30 percent are powered by diesel, and only 0.4 percent is solar (Kalamkar *at el.* 2019) [10].

Irrigation pumps used in agriculture require roughly 25 per cent of India's total electricity, consuming 85 million tons of coal yearly, and 12 per cent of India's total diesel usage, totaling over 4 billion liters. The water pumps are running through diesel and electricity and causing an increase in the economic burden to the farmers. Solar pump set do not require any fuel or electricity to operate, so solar powered pumps are emerging as an alternative solution to those powered by grid electricity as well as diesel. Diesel and electric pumps have low capital costs but their operation depends on the availability of diesel fuel or a reliable supply of electricity. It is estimated that a saving of 9.4 billion liters of diesel over the life cycle of

solar pumps is possible if 1 million diesel pumps are replaced with solar pumps (Kalamkar *et al.* 2019) ^[10]

There are many advantages of solar pump set included that the low operating cost, free from fuel, environmental ecofriendly, less maintenance required easy transportation. The major disadvantages are included that the more expensive and its output are depended on the weather conditions etc. The major problem of this system is expensiveness but to make it affordable to the farmers by government through provides huge subsidy under different schemes for the installation of this system (Narale and Rathore, 2013) ^[11].

- Pradhan Mantri Kisan Urja Suraksha Evam Utthaan Mahabhiyaan Scheme (PM-KUSUM)
- Sour Sujala Yojna Scheme

In the year 2021 the total numbers of 286830 solar pumps set have been installed in India, out of which 96399 solar pumps have been installed in Chhattisgarh. Chhattisgarh holds 1st position in India in installing maximum number of solar pump set. In Bilaspur district 1491 solar pumps have been installed till now. In Chhattisgarh there is a scheme being run by state government named as Sour Sujla Yojana under which 90% to 97% subsidy is provided to farmers. The district of Bilaspur has four blocks *i.e.* Masturi, Takhatpur, Bilha, and Kota. The solar pump set was installed at Masturi (623), Takhatpur (413), Bilha (259) and Kota (196) (CREDA 2021).

Chandrakala studied (2020) ^[7] that before installation of solar pump set by the farmers, in kharif season they were used to grow paddy, maize and Lathyrus and during the rabi season they used to grow paddy, wheat, chickpea, moong and Lathyrus. The net cropped area was 2.99 ha, whereas the gross cropped area was 3.63 ha found with a cropping intensity of 121.63 percent. It was found that the gross cropped area increased by 5.43 ha which accounts cropping intensity of 181.60 percent after installation of solar pump set by the farmers. This has relatively impact on other crop on increasing its cropping area, such as, pea in Rabi season and coriander in summer.

Materials and Methods

Sampling framework

Bilaspur district was selected purposively. Out of four blocks, two blocks namely Masturi, Takhatpur were selected on the basis of the maximum number of solar pump sets installed. Out of 71 and 53 villages from Masturi and Takhatpur a total of 12 villages *i.e.* 7 villages (Chilhati, Gobari, Gataura, Jondhra, Kukda, Luthra and Malhar) from

Masturi and 5 villages (Nawagao-Kathakoni, Khudhiyadih, Lakhasar, Mochh, and Umariya) from Takhatpur which is 10% of total were selected on the basis of the maximum number of solar irrigation pump sets installed. A 45 percent of total number farmers who use solar pump set were considered as respondents; accordingly 51 and 31 farmers were selected from Masturi and Takhatpur block respectively.

Collection of data

Primary data were collected for the study from solar irrigation pump set user farmers with the help of well-prepared questionnaire and schedule. Secondary data were collected from the records of Ministry of New and Renewable Energy Govt. of India (2020-21), Chhattisgarh State Renewable Energy Development Agency (CREDA), district- Bilaspur and also Raipur district, the office of Deputy Director, Department of Agriculture, district - Bilaspur, District Planning and Statistical Office, district Bilaspur, the office of Senior Agriculture Development Officer, block- Takhatpur and Masturi, district- Bilaspur (Chhattisgarh) and other authentic sources.

Analytical tools and techniques

$$\text{Cropping Intensity} = \frac{\text{Gross sown area (ha)}}{\text{net sown area (ha)}} \times 100$$

Results and Discussion

The cropping pattern and cropping intensity of sample farmers were changed after installing solar irrigation pump set for the agriculture purposes. It was reported that before installing solar irrigation pump farmers were cultivating paddy and pigeon pea in kharif season and paddy, wheat, Lathyrus, coriander and chickpea during Rabi season. The summer season was left for fallow.

After installing a solar irrigation pump, farmers changed their cropping patterns. Now cultivating area also increased and some new crop are taken like chilli, brinjal and papaya in kharif season, tomato in Rabi season and okra, blackgram and mungbean in summer season.

It was reported that before installing solar irrigation pump net cropped area was 2.14 hectare, gross cropped area was 2.98 hectare and cropping intensity was 138.78 percent.

Now, after installing solar irrigation pump gross cropped area and cropping intensity were increased to 4.36 hectare and 203.73 percent respectively.

Table 1: Impact of solar pump set on change in the cropping pattern and cropping intensity of Bilaspur district of Chhattisgarh

Season	Crop	Area (ha.)	
		Before using solar pump	After using solar pump
Kharif	Paddy	1.73	1.76
	Pigeon pea	0.41	0.03
	Chilli	0	0.16
	Brinjal	0	0.05
	Papaya	0	0.14
	Sub Total	2.14	2.14
Rabi	Paddy	0.10	0.98
	Wheat	0.09	0.30
	Chickpea	0.07	0.21
	Lathyrus	0.48	0.14
	Coriander	0.09	0.19

	Tomato	0	0.08
	Sub Total	0.83	1.90
Summer	Okra	0	0.05
	Summer black gram(urad)	0	0.16
	Summer mung	0	0.11
	Sub Total	0	0.32
	Gross cropped area	2.97	4.36
Net cropped area	2.14	2.14	
Cropping Intensity	138.78	203.73	

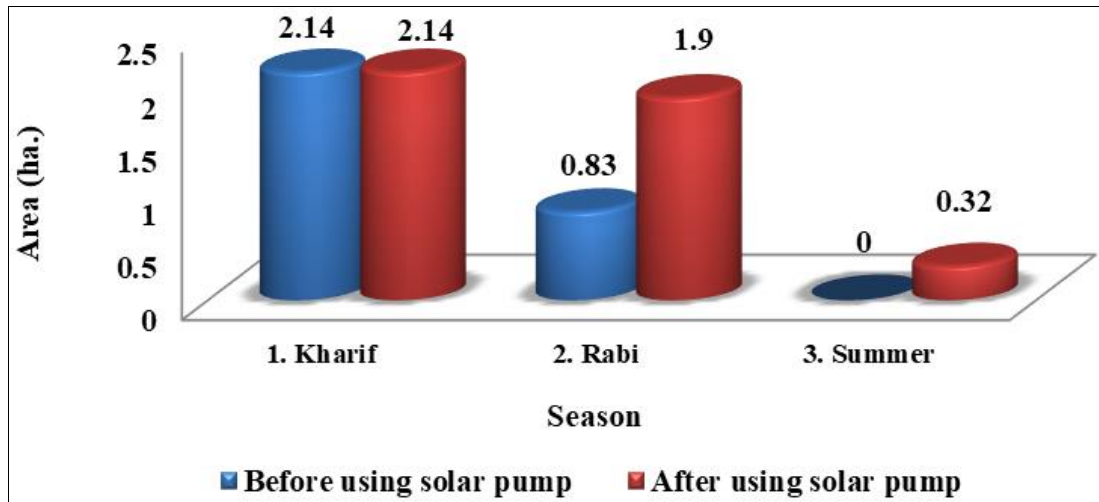


Fig 1: Cropped area by season

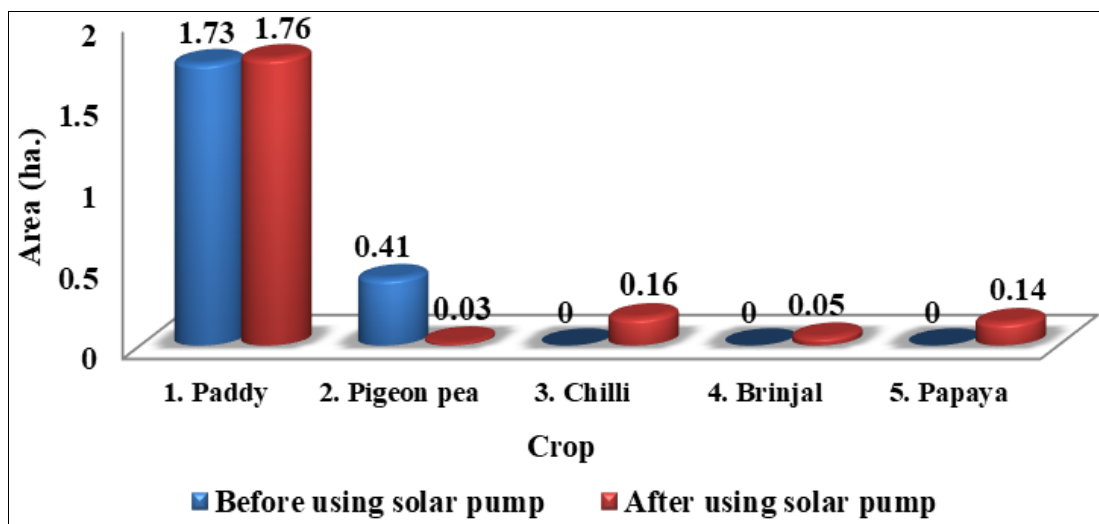


Fig 2: Kharif Season

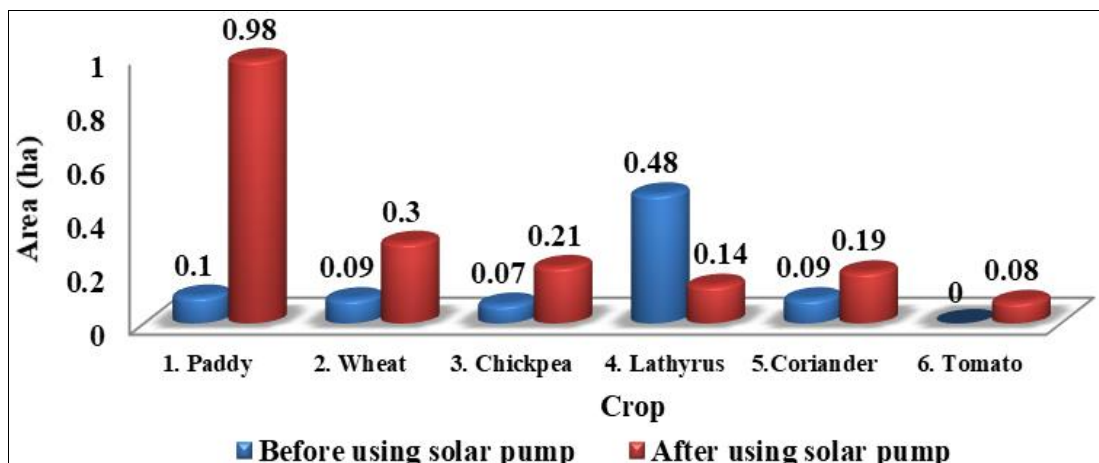


Fig 3: Rabi season

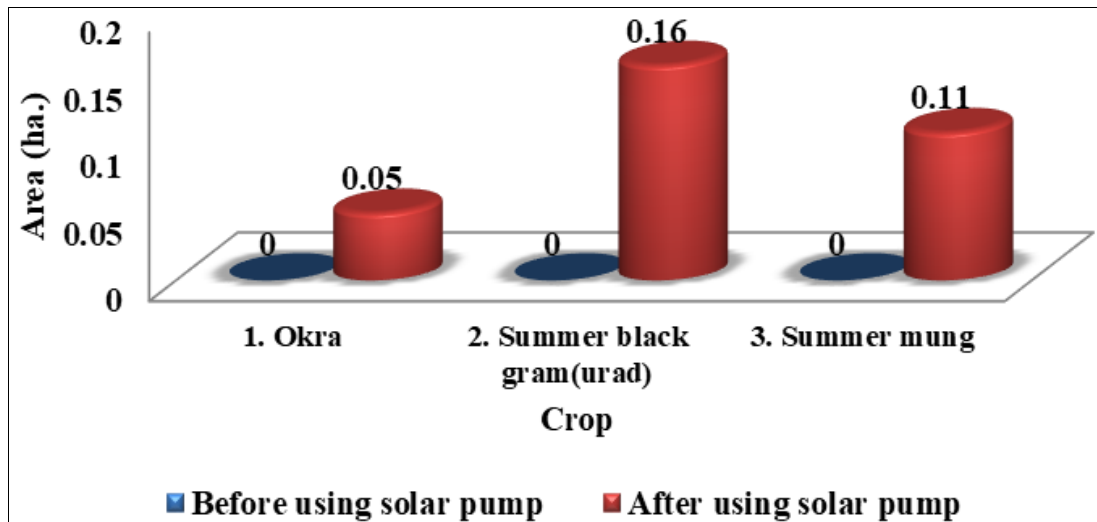


Fig 4: Summer Season

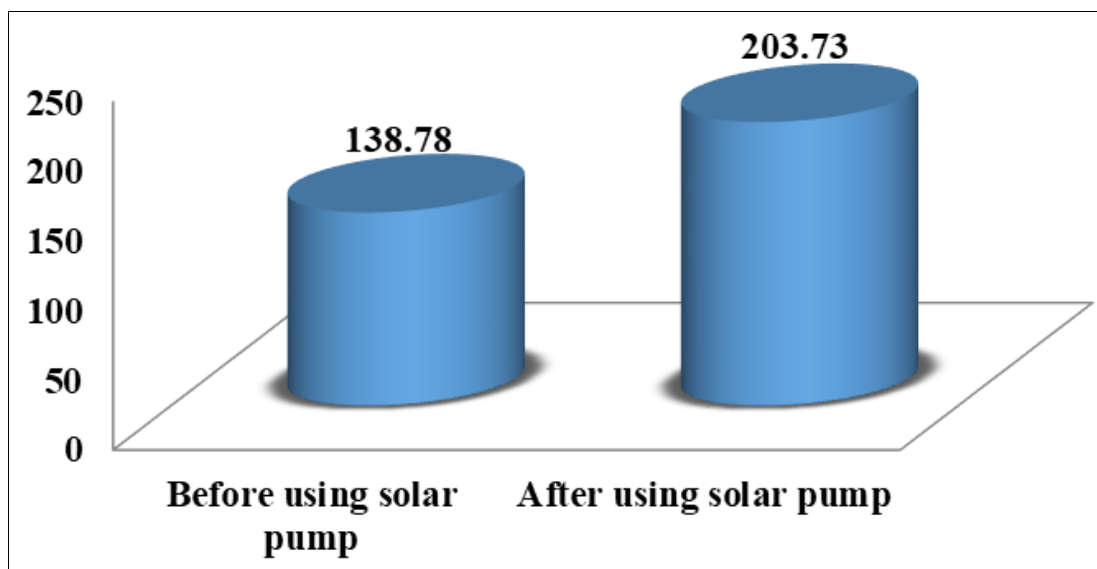


Fig 5: Cropping Intensity

Conclusion

A study was conducted in Bilaspur district of Chhattisgarh and two blocks namely Masturi and Takhatpur were selected on the basis of the maximum number of solar pump sets installed. It was reported that before installing solar irrigation pump net cropped area was 2.14 hectare, gross cropped area was 2.98 hectare and cropping intensity was 138.78 percent. Hence, the gross cropped area and cropping intensity were increased 4.36 hectare and 203.73 percent respectively after adopting solar irrigation pump by the farmers.

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