

Irrigation Challenges amidst climate variability: Role and relevance of SRI Revolution in Bihar

*Dr. Anita Shrivastava, Assistant Professor,

* Manish Kumar

Department of Mass Communication,

Patna Women's College, Patna.

Abstract

Bihar, where floods and droughts are recurring disasters, is in Indo- Gangetic plains consisting the fertile soil, irrigated by the river Ganges and its tributaries as well as by the ground water resources. The 60 percent area of land is used for cultivation which is much higher than national average (42%). Though the whole of Bihar lies in a humid zone with an annual rainfall of more than 1200 mm which is sufficient for kharif crops like paddy and maize, but its occurrence and distribution of rains are highly erratic and distinctly seasonal in character. The consequences of such erratic climate become very severe in a region like Bihar where rice is the most important crop, grown in all 38 districts.

In the absence of adequate rainfall most part of Bihar faces drought situations. 33 out of 38 districts were declared drought hit in 2013. Again in 2014, 28 districts were declared drought hit due to scanty rainfall which badly affected the transplanting of paddy and other crops.

Any deficit/excess of Indian Summer Monsoon Rainfall (ISMR) on climatologically fixed dates influences agriculture in the state, especially rice. This crop is highly sensitive to drought so much so that the entire crop may fail for want of one or two critical watering. Here lies the significance of SRI Technique of paddy cultivation i.e.; an improved technique of rice cultivation which requires reduced irrigation. Intermittent irrigation' or 'Alternate Wetting and Drying (AWD) method of irrigation is the distinguishing feature of SRI technique of rice cultivation.

Bihar has been deprived of the benefits of Green Revolution but it has also remained untouched with the ill-effects of green revolution which resulted in the soil pollution and fertility reduction. SRI revolution which has sought by the Bihar government in its agricultural roadmap (2012-2017), may prove a ray of hope for drought-prone rice growing districts of Bihar by reducing water use for irrigation.

Key words: Drought prone, Rainfall, water resources, soil pollution, intermittent irrigation.

I. Introduction:

Climate variability is expected to have a major effect on the global environment as well as most direct impacts on the regional weather patterns resulting in erratic or abnormal rain and drought events. According to the intergovernmental panel on Climate Change (IPCC) Assessment Report, the poorest countries would be hardest hit, with reductions in crop yields in most tropical and sub tropical region due to decreased water availability. The climatologist do predict the occurrence of frequent climatic extremes as the routine events in the future, which will have its impact directly as well as indirectly on agriculture and ultimately on human life.

Bihar's agriculture is directly being affected by climate change. Recurring floods and droughts are threatening the crop production. The monsoon in the state often starts late and recedes early. The consequences of such erratic climate become very severe in a region like Bihar where rice is the most important crop covering about 45 percent of the net cropped area. This crop is highly sensitive to drought so much so that the entire crop may fail for want of one or two critical watering. Hence lies the significance of SRI Technique of paddy cultivation i.e.; an improved technique of rice cultivation which requires reduced irrigation emphasizing the individual plant quality over quantity i.e. "less-is-more" approach to rice cultivation which is vulnerable to climate fluctuations. An extensive study and analysis is required and the need of new dimensions in the agricultural scenario of Bihar. And SRI is one of them. An attempt has been made in the present paper to highlight the adaptability of SRI Technique to climate change and other positive aspects of newly promoted approach in Bihar's agriculture.

II. Objectives of the Study:

It is to be remembered that while water scarcity is found everywhere across the globe, to produce one kilogram of rice the farmers in general reported to use an alarming quantum of about 15,000 litres (Rajendran 1992) under flood irrigation system for rice transplanted fields. Such huge water use resulted not only in excessive weed growth but also salinization and water logging erupted in long run.

SRI crops can substitute the water-guzzling crops. Environmental disasters like the destruction of aquifers by farmers getting free electricity and diversion of scarce canal water to water-guzzling crops like sugarcane and paddy at the expense of crops like maize needing much less water may be minimized by the adoption of SRI crops.

The objective of the study is to analyze the irrigation potentials in Bihar amidst climate variability and conduct a comparative study of conventional method of paddy cultivation and SRI technique regarding less water use in changing climatic scenario. The aim is to analyze the water management practices to solve the irrigation related problems in Bihar.

III. Hypotheses:

- Rice cultivation and water use are positively correlated
- Irrigation facilities are insufficient in Bihar resulting in poor yields.

- SRI is an alternate method most suitable for Bihar state which is devoid of irrigation facilities.

IV. Irrigation potentials in Bihar

Bihar's agriculture is largely rain-fed. It has a fair amount of rain as compared to other states yet it has poor irrigational facilities in comparison to others. Only 50-60 percent of land is covered by irrigation facilities. There are six major sources of irrigation-surface canals(major),surface canals(minor),tanks(including ahars and pynes),tube wells, wells,ponds and other sources. There is heavy dependency on tube-wells, which in turn, are dependent on electricity, which is in short supply. There is also the high cost of diesel for running the tube – wells which provides more than 50 percent of the total irrigation in 38 districts..It is a vicious circle which makes irrigation, nothing more than a pipe dream for farmers.

V. Water Management Practices for rice

The bulk of the acreage under rice in India depends on rainfall for its water supply and only about 38 per cent of the total rice area in India is irrigated to supplement the rainfall. Since the water requirement of rice is higher than of any other crop of a similar duration, assured and timely supply of irrigation water has a great influence on the yield of the crop. On an average, about 1.25 cm (1/2 inch) of water per day is required.

A rice crop of about 150 days duration requires 63.5 cm of water for raising nursery, 101.6 cm for growth from planting to flowering and a further amount of 25.4 cm for ripening making the total to 190.5 cm (Ramiah and Vachhani, 1951).

VI. Problems/Constraints of irrigation in Rice

- About 91 % (1.61 Crores) of the farmers in Bihar are small and marginal and they are poor in resource. Therefore they are not in a position to arrange for the artificial means of irrigation necessary for their rice crops.
- Often rice crop suffers with soil moisture stress due to erratic and inadequate rainfall. In upland soils rainwater flows down quickly and farmers are not able to conserve the soil moisture. There is also no facility for life saving irrigation particularly in upland and draught prone rainfed lowland areas.
- The problems of flash floods, water logging/ submergence due to poor drainage, low-lying physiography and high rainfall in submergence prone lowlands are in north Bihar areas.
- Delay in monsoon onset often results in delayed and prolonged transplanting and sub-optimum plant population (mostly in rainfed lowlands)
- In upland, rain fed rice crop is grown under rainfed conditions, the growth is mostly dependent on the vagaries of the monsoon. In the years of scanty or adverse distribution of rainfall, the crop fails owing to drought and in the years of heavy rainfall, particularly during blossoming, there is poor grain setting.
- In the high rainfall region, the rainwater is lost rapidly through deep percolation, because of the upland location and loose texture of the soil. In these soils the plant nutrients applied through fertilizers are also

lost rapidly and investment on fertilizers becomes risky. Further low water retention capacity by the soil due to high permeability brings in moisture stress condition quickly after the cessation of rains.

VII. Irrigation Water Management and Relevance of SRI in Bihar:

Water is a precious input for agriculture; hence its quantity, time and method of irrigation must be taken into account to obtain the best results. No doubt, rice alone consumes a major share of country's irrigation resources. Rice is a semi-aquatic plant. Because of the fact that rice is grown in different seasons, variable topo-sequence and different soil conditions, the need of water for rice differs considerably. No doubts, the soil submergence suppresses weed growth and increases the availability of P and Fe to the plants, but it also enhances percolation losses of water and thus increases the water needs of rice by 3-10 times as compared to upland crops.

In SRI technique of cultivation, which is being adopted by small farmers of Bihar, there is vast scope for economizing water and improving the low water use efficiency of rice.

Experiments of SRI practices reveal that there is considerable saving in water, when submergence was maintained only between tillering till flowering and near saturation conditions at other growth stages. Water requirement was reduced by 22-40% by following this intermittent irrigation practice without any reduction in yield.

Benefits of SRI:

1. **SRI** method totally deviates from the traditional way of cultivating irrigated paddy over centuries and hence it has different water frees up water for other uses and soil that is not kept saturated has greater biodiversity. Unflooded paddy fields do not produce methane, one of the major "green house gases" that are contributing towards global warming.
2. Less water use (30-50%). Only a minimum of water is applied during the vegetative growth period. A 1-2cm layer of water is introduced into the paddy, followed by letting the plot dry until cracks become visible, at which time another thin layer of water is introduced. Reducing water use is a ray of hope for drought-prone rice-growing districts of Bihar.

Table-1: water use statistics in different Rice

Crop	No. of Irrigation	Irrigation Time	Total Quantity of Irrigation(cm)
Summer Rice	17-20	1-3 days after drying	100-200
Winter Rice	3-6	3 days after drying field	21-42

SRI	3-4	Alternative wetting and Drying	1-2

Source: Based on Field Survey

3. In recent years, the frequency of occurrence of floods and droughts has increased in Bihar affecting Rabi and Kharif crops. At one end, the paddy crops are destroyed by excessive floods in north Bihar, on the other hand, the districts of Rohtas and Kaimur- well known as 'Bowl of Rice'- largely experiencing uneven distribution and deficit of ISMR(Indian Summer Monsoon Rainfall) in last five years.

Recently, in a field survey conducted in Raksa Paschim Tola village of Marwan Block of Muzaffarpur district of Bihar (Table 2), it was found that the farmers who practiced SRI in their fields were more benefitted than those who followed the conventional method of rice cultivation as monsoon failure affected the crops.

Table 2:

Farmer S.No.	Total land	Used for SRI	Traditional rice(productivity/kattha)	SRI rice(productivity\kattha)
1	5 kattha	2 kattha	40kg/kattha	70kg/kattha
2	1 Bigha	1kattha	25kg/kattha	65kg/kattha
3	5kattha	2kattha	10kg/kattha	65kg/kattha
4	8kattha	2kattha	22kg/kattha	67kg/kattha
5	7kattha	1.5kattha	25kg/kattha	70kg/kattha
6	4kattha	1kattha	25kg/kattha	60kg/kattha
7	10kattha	3kattha	10kg/kattha	65kg/kattha
8	1 kattha	1 kattha	-	70kg/kattha
9	2 kattha	2 kattha	-	68kg/kattha
10	12 kattha	4 kattha	32kg/katha	65kg/kattha

‘Alternative Wetting and drying

Source: Field Survey by Researcher after Harvesting (12Nov; 2016) of rice fields

4. Alternate wetting and Drying System of Irrigation in SRI

During flowering a thin layer of water is maintained, followed by alternate wetting and drying in the grain filling period, before draining the paddy 2-3 weeks before harvesting. This method is called ‘intermittent irrigation’ or (AWD).

Intermittent irrigation saves water requirement of rice, ranging from 21% to 68%.



SRI rice field showing cracks when alternate wetting and drying irrigation is applied

5. SRI challenges traditional practices of rice farming where mature seedlings are planted in clumps, fairly closely, with standing water maintained on the field for as large part of the season as possible with the idea of reducing the risk of crop failure. On the other hand, in SRI, young seedlings (8-10 days) are carefully transplanted and irrigation is provided intermittently whenever land is dry with no standing water on the field. Scientifically, this appears to help healthy growth of plants with stronger root zone due to better availability of oxygen at the root zone than those for plants grown under traditional practices.

VIII. Problems and Recommendations:

- a. SRI technique can be adopted only on upland rice which is 20% of total cultivable area. The loss incurred by flooded area can be compensated as SRI enhances productivity 3-4 times.
- b. Lack of awareness among farmers towards benefits of SRI may be removed by strengthening the agricultural extension services by the live departments.
- c. Line departments, banks and beneficiaries are found to be working in isolation without necessary coordinated effort to harness the irrigation potentials available in the state.

- d. Canal and groundwater are the main sources of irrigation in the state. But its supply is erratic as siphons are not working properly. Subsidies for diesel are not given to poor landless farmers. Erratic supply of electricity should not be corrected.

IX. Conclusion:

If Bihar can have 100 per cent quality seed with required quantities of organic manure along with micro nutrients and of course, a rationalized use of water, there is every reason for the state to claim its rightful place as the fore-runner of second Green Revolution in the country. Infact, this increased production which will certainly come with promotion of SRI technique in the state which is facing water scarcity, may be termed as SRI Revolution.

Yield rate of rice has been unsatisfactory due to flooded and submerged fields every year. 50 per cent of cultivable land is drought prone of which only 25 percent is under irrigation. There is a need to adopt alternative and innovative strategies for agricultural development- the system of Rice Intensification which is a water efficient strategy.

