ANALYSIS OF CROPS' PRODUCTIVITY POTENTIAL AND DRIP IRRIGATION SYSTEM IN INDIA – POLICY IMPLICATIONS

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ABSTRACT

India faces 'relative scarcity' of water. Drip irrigation system - a water saving technology simultaneously enhances crops' productivities. This paper on economic worth of the system has been undertaken in a hilly state through objectives: to analyse existing status of water resource potential, drip system and crops' productivity; work out cost effectiveness and find out remedial measures for providing input to the policy frame work. The results have revealed positive economic impact with respect to 18 % higher benefit cost ratio by adoption of this system on account of enhanced apple productivity. Huge unexplored water potential in the state can further be explored for increasing irrigation and potential area for installing this system. The system related problems, existing water policy guidelines and scientific recommendations have lead to future policy implications

Keywords: Relative scarcity, water saving technology, economic worth, cost effectiveness, crops' productivity, policy.

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1. Introduction

Scarcity in abundance' has been found to be managed by improving water use partly through adopting water saving technologies. India has only less than 10 per cent of irrigated area under sprinkler and micro irrigation and developmental efforts of the concerned agencies in public and private sector have been engaged in accelerating the growth of micro irrigation technology in the light of its' the biggest benefit of enhancing crops' productivity by 3 to 5 times. This study has been undertaken to show the economic worth of drip irrigation system with specified objectives through affecting crops' productivity in hilly state of India – Himachal Pradesh.

Objectives :

(i) To analyse existing status of water resource potential, drip system and crops' productivity**,**

(ii) To work out cost effectiveness of drip irrigation system and

(iii) To work out remedial measures against farmers' problems for providing input to the policy frame work.

2. Methodology

Time series data (2002-2012) have been collected on the existing land, water related parameters and major crops' productivity. Data analyzed have been collected from 130 respondents with and without drip irrigation sites from Shimla district of Himachal Pradesh. Data have been analyzed by adopting economic and statistical tools along with environmental techniques for finding out economic worth indicators viz. costs, returns, benefit cost ratios and crops' productivity. The growth trends have been found using equation $\mathbf{Y = a.X^b}$ and (b-1) X 100. The cost effectiveness has been validated by working out net **additional annual cash flow** based on respondents' responses. Inputs implication to the policy issues has been based on multiple responses, scientific recommendations and development oriented existing water resource projects/programs.

3. Results and discussions

3.1 EXISTING STATUS OF WATER RESOURCE POTENTIAL, DRIP IRRIGATION SYSTEM AND CROPS' PRODUCTIVITY

3.1.1 Water Resource Potential

Two major river basins namely **INDUS AND GANGA** have more than **1/3rd of total catchment area of the country** and 100 per cent catchment area equivalent to total geographical **area of the State** (study area) **Fig.1**. Percentage of **utilizable surface water** in these two major river basins has been worked out to be about **63 % (INDUS)** and **48 % (GANGA). Thus, no absolute scarcity of water simultaneously revealing lack of water management at micro and macro level. In Himachal Pradesh,** the irrigation potential created through major/medium and minor irrigation schemes has shown a positive trend with an increase of about 26.37 per cent in irrigation potential created during the last decade **Table-1**. **Ground water development** has been found to be lower (30%) in the state than the national level (58%) **The existing irrigated area has been worked out to be 19.5% of the net cropped area in the state as a consequence of water resource development programs vis-à-vis 40% in India.**

3.1.2 Drip Irrigation system in India and State of HP

Growth of micro irrigation in India has been showing increasing trend since the inception of micro irrigation scheme with a growth rate of 4.1% per annum (2005-06 to 2010-11) **Fig.2.** However, growth of drip irrigation system has been showing higher growth rate of 11.9%/annum (t_c=3.597>t_t=3.250 at0.01 level) during 2001-02 to 2010-11 **Fig.3.**

Himachal Pradesh government has allocated huge funds for developing microirrigation. Consequence upon this, Micro Irrigation Project under Department of Agriculture has shown about 24% higher targets achieved for installation of sprinklers whereas 8% higher targets have been achieved in case of drip irrigation system. There has been a manifold increase in area under sprinkler/drip units (No. 240 to 17312) and water tanks (No 16020) in the state during 2004-2005 to 2012-2013 and these efforts have lead to an increase in area under flowers from 129 Ha to 556 Ha and vegetable production from 7.31 lakh tonnes to 13.57 lakh tons during the same period. Simultaneously, average land holding size has decreased from 1.20 Ha to 1.04 Ha i.e. by about 20% during this period, therefore, importance of micro irrigation technology with respect to crops' productivity becomes more relevant in the times to come.

3.1.3 Crops' Productivity in Himachal Pradesh - India

Although the crops' productivity in the state, in general, have been worked out to beincreasing over a period of time within a percentage range of 23.86 to 32.70, yet at the existing levelof land holding size and water available for irrigation, the crops productivity in the State have been reported to be lower (about less than half)than the national level and about 3 to 10 times less than the global averages in case of total food crops, total fruit crops and apple crop in specific **Table- 2** . Undiscounted benefit cost ratio under drip irrigation has been found to be Rs.2.98:1 against rainfed condition Rs. 2.52:1 i.e. about 18% higher for higher productivity.

3.2 COST EFFECTIVENSS OF THE SYSTEM

The cost effectiveness of DIS in terms of water saving and enhancing crops' productivity has been recognized at national level and study area in the state **Table-3.** The respondents have revealed cost effectiveness of the system with respect to water saving (25%),enhanced yield of apple (35%), saving in labor (90%),various inputs' use efficiencies 25 to 50% and irrigation efficiency by 66%. Similarly, trends of productivity of fruits and vegetables in different parts of the country have shown a positive response with drip method due to increased water use efficiency.

Figure 3: Major River Basins of HP REd Marked 'Sutlej'

Table 2: Existing irrigation potential available/created

Sr. No.	Items	2003-04	2012-13	% age change
1.	Irrigation Potential available			
1.1	Major/Medium Irrigation schemes	0.50	0.50	
1.2	Minor irrigation schemes	2.85	2.85	
2.	Irrigation potential created	2.01	2.54	*+26.37*

Figure 3 : Micro irrigation development in India

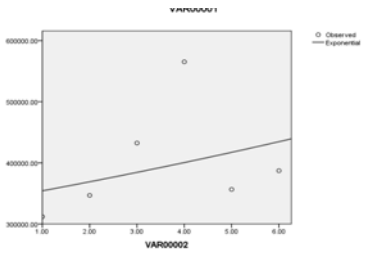

Figure 3 : Growth of Drip irrigation method in India

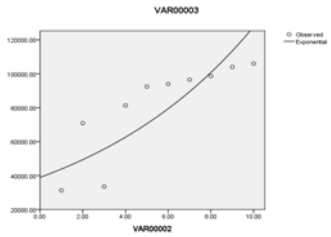

Table 2 : Crops' Productivity in Himachal Pradesh, India and at global level

		(MT/Ha)		
		2008-2009	2012-2013/2010/2010	
1.	Total Food Crops	1.53	1.96/(2.8-3.3)/(8.9-10.8)	28.10
2.	Total Fruit crops	3.06	3.79/(6.3-37.8)/(40.6-59.3)	23.86
3.	Apple Crop	5.23	6.94/11.0/18.0	32.69

Table 3 : Cost effectiveness of Drip irrigation System in HP

Sr. No.	Particulars	%age
1.	Water Saving	25
2.	Enhanced yield	35
3.	Saving in labour	90
4.	Control of weeds	40
5.	Economy in other cultural operations	50
6.	Improvement in fertilizer use efficiency	25
7.	Reduction in plant protection measures	30
8.	Irrigation Efficiency	66
9.	Enhanced Benefit cost ratio (Rs.)	2.98:1

Table 4 : Problems faced by the Orchardists in HP

SrNo	Problems	% age
1.	Expensive system	70
2.	Lack of awareness	55
3.	Lack of adequate technical know how	70
4.	Quality of the material - Life of the system Cracking/leakages of pipes	 20 40
5.	Operational problem Clogging of drippers, Rodents' damage of plastic material	 56 90
6.	Insufficient after sale/installation service	98
7.	Lack of trainings/skill	80

χ^2 = 80.9111 significant at 0.01 ; χ^2 = 29.2083 significant at 0.01

3.3 FARMERS' PROBLEMS AND REMEDIAL MEASURES AS STRATEGIC POINTS TO POLICY FRAME WORK

According to **National water Policy,** there has been limits on utilizable quantities of water due to uneven distribution of rain fall over time and space and large parts of India have already become water stressed, **hence unified national perspective** needed for management of water resources in the country. The respondents' responses, on their problems with respect to installation and operation and maintenance of the drip system as shown in **Tabe-4** along with their remedial measures; policy terms for exploring water use efficiency in the light of scientific recommendations on On-Farm irrigation systems specifically drip system, have been used to evolve remedial measures/strategic points for bringing improvements in the policy frame work :

Purchasing Power of the beneficiaries : Small sized land holding under majority portion rainfed has ultimately lead to very l ,low yields and corresponding lower purchasing power that has, however, been taken full care during 2014-15 by raising **subsidy** level to 80% in the state. Other states also need similar incentive.

Strengthening of education system in the state to raise literacy level of the beneficiaries that will raise grasping levels to understand **technicalities**.

Strengthening of Extension Services through the development schemes of the related public and private agencies/departments in association with State Agriculture/Horticulture/Forestry Universities by imparting **trainings** on scientific lines.

Ensuring water availability by **micro level planning** of available water resource either on the farm or in the vicinity of farms. This requires immediate action due to **immediate water need** as macro level planning may take time.

Top priority to water related development programs at macro level –National scheme on micro irrigation has been implemented with a missionary zeal to use this technology on the farm. The **macro level planning nation/state-wise** has been considered a **pre requisite** so as toenhance irrigation potential and save water further through such water saving methods for makingfood security 'an achievable challenge' on sustainable basis.

Innovative idea : Innovative ideas based on existing research

This can be achieved by **taking the river basin as the basic hydrological** unit for spreading/linking branches of irrigation around this basic unit. This will not only sustain irrigation in the country as a whole but also yield multifarious advantages.

Involvement of Applied Social Scientists. In drip irrigation scheme questions like - What has been the **Supply level** of water and it's **demand** in various uses? Whether Investment will be economically viable? **What will be the productivity gains**? **How much will be the water saving** ? What will be the Pay Back Period, Net Present Worth, Annuity, IRR etc. only **involvement of Applied Social Scientists** (**Applied Economist**, Extensionist, Sociologist and Psychologist etc)at all the stages of project can ensure answers, **ensuring further weighted irrigation development index.** (Presently IDIw = 0.44).

Ergo, 'a sustainable **multi-disciplinary model' based on Supply of and demand for water** involving **Psycho-Socio-techno-economic flow of parameters** must be the back bone of water resource development projects.

4. CONCLUSIONS

- No absolute scarcity of water only '**relative scarcity'** exists that needs water management **in the light of strategic points.**
- **Greater 'drip utility'** if water resource available planned at micro level by enhancing irrigation potential through on going irrigation schemes and macro level by considering '**river basin'** as a **basic and starting unit** of over all water resource development.

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