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REMODELING OF DEEP TUBE WELL SETTING ENHANCING IRRIGATION EFFICIENCY AND ENVIRONMENTAL SAFETY AND BIODIVERSITY IN BANGLADESH

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ABSTRACT

Talukder S (2013) Remodeling of deep tube well setting enhancing irrigation efficiency and environmental safety and biodiversity in Bangladesh. *J. Innov. Dev. Strategy*. 7(1), 61-65.

A study was conducted on the Remodeling of Deep Tube Well (DTW) setting to increase irrigation and water use efficiency saving the natural environment specially the use of underground water in Bangladesh. The work was done with the specific objective to identify the problems relating DTW irrigation and its probable bio-hazards and on eco-environment and to develop a DTW setting model as to overcome the situation. The work covered 4 regions distributed over the country having potential of different underground water table and intensity of water use. The results showed that the movement and storage of the aquifer in deeper strata is not so good for installation of DTW having higher water lifting capacity. Ground water level status was found to be greatly improved by augmented rechargeable water from surface water irrigation or from other sources like rain water. During and after irrigation the effects of ground water table should be reviewed time to time during the process of implementation and based on the actual impacts the project activities particularly trend of water table fluctuation needs to be monitored to avoid adverse impacts on ecology. Artificial recharge to improve ground water, specially in the northern region area is strongly recommended which experiences were taken in this study is and thus a model has been developed which can improve the situation by up to 25%. However, further hydro-engineering studies are required to confirm the present findings.

Key words: *remodeling DTW, irrigation efficiency DTW setting, water recharging, biodiversity*

INTRODUCTION

It was frequently reported by the Department of Agricultural Extension (DAE 2006, 2007) and Bangladesh Agricultural Development Corporation (BADC), through Bangladesh Agricultural research Council (BARC) that the efficiency of irrigation using underground water has fallen to the level of critical mark 48% (BARC 2008). They reported that the cost of agricultural crop production now involves about 30% of the expenditure for irrigation purpose and this is increasing every season. The main reason causing these problems were reported to be lack of underground irrigation water and less standard installation of the tube well. A Comprehensive study was carried out in 1980 concerning the tube well irrigation in the northern region of Bangladesh, by Bangladesh Water Development Board (BWDB 1982) for deep tube wells. But most of the deep tube wells have greater effects on the ground water tables in terms of aquifer parameters and recharge, zone suitable for development or shallow tube wells development have been delineated. Most of the deep tube wells are not encouraged due to the decreasing of ground water table in the dry season and have greater effects on the present changed climate condition. On the other hand for such a level of abstraction may result in dried up shallow wells, hand pump wells and dug wells in some parts of the northern region in Bangladesh. So, upgrading and modernization of tube wells irrigation project is the most and maximum demand of the present nation; otherwise in this condition of approaching failure of previous irrigation system and due to climate change both will create the dessert condition in the northern and Southern (BIP 2000) part of Bangladesh. This failure rate will increase day by day. Hence, without tube well remodeling as regards its establishment, no other low practical alternative way to safe the people of Bangladesh. Considering the rationale of the situation a research program was implemented with the specific objectives to identify the present problems relating DTW setting and its hazards on environment and to develop one model to overcome the problem.

MATERIALS AND METHODS

The major research part of the study has been conducted using technical field study method using a technical questionnaire.

Questionnaire Guideline

A. Personal and DTW Information: It included address, History of the DTW, present status of the DTW, irrigation command area and DTW specifications. The methods used in the studies were selected as per recommended by different workers (Grameen Krishi Foundation, 2002 and MOA. 2006).

B. Technical Information: It included main problems of irrigation equipment such as poor installation, non-technical management, and shortage of water delivery, level of energy use and age of DTW. The second parameter was relating to technical activity as a part of remodeling such as using shallow engine, water recharge estimation, water loss modeling, and conversion of energy source and environmental management of DTW. The third parameter included in the study comprised causes of poor functioning of the DTW such as lack of water in peak season, water loosing in lean season, damage of biodiversity and public health, decreased agricultural production thus increasing poverty. The fourth parameter selected for study was component elements of DTW namely minimum use of the DTW, strong lining of the bore, increasing water soaking/ recharging, reinstallation and using strong metallic pipes. Investigation was done to determine the safe base size of DTW from 7-17 meter length width dimensions. The study was conducted covering 100 sites and 200 sets as available.

Site selection was done from different regions and districts such as Northern Region: Dinajpur (Fig. 1), Thakurgaon, Panchgarh; Western Region: Jessore, Jhenaida, Magura; Southern Region: Patuakhali, Barguna, Chittagong, Cox's bazar; and Central Region: Dhaka, Munshiganj, and Narayanganj. The study was enriched with Focus Group Discussion in offices and sites.

Fig. 1. DTW not working due lack of water: Dinajpur Barind site

RESULTS AND DISCUSSION

The results obtained from the present studies are sequentially mentioned and interpreted here. The results are given in both tabular and graphical forms as found suitable and briefly discussed.

Problems of irrigation equipment

The study results as given in the Table 1 and Fig. 2 on the dominant problems related to the use of irrigation equipment show that poor unscientific installation of the sets caused unsatisfactory performance as responded by about 72% respondents being mean of 4 regions. This was followed by old age long duration of the sets as responded by 64% in the northern region.

Table 1. Problem of irrigation equipment as prioritized by the % respondents

Parameter	Northern region	Western region	Southern region	Central region	Mean
Poor installation	72	63	51	57	60
Non- technical management	68	42	46	38	49
Shortage of water for delivery	54	36	52	47	47
Level of energy use	42	37	29	41	39
Age long duration of set	64	53	46	44	52
Others	27	15	19	25	21

The results show that poor installation (60%) was the main cause of the problems followed by duration of the (52%) of the structures. The results indicate that North region was most affected followed by the Central region.

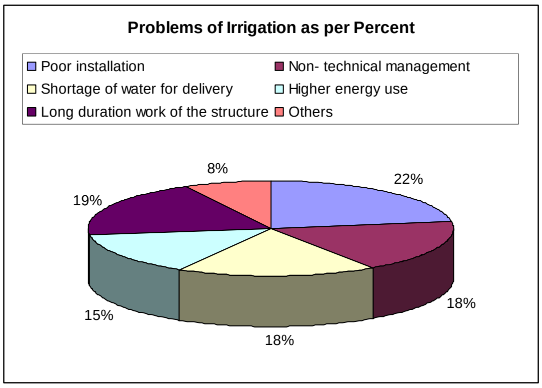

Fig. 2. Mean irrigation problems as per response

Technical Activities

The results on the priorities of activities problems of irrigation as per percent responses are given in the Table 2 and Fig. 3. The activities compared in the study were using shallow engine, water recharge estimation, water loss modeling, and conversion of energy sources and technical management of the sets/plant. The results showed that water recharge estimation scored highest being 78% response followed by technical management of the sets being 60% in the northern region. The other regions showed similar trends of required technical activities. It indicates very severe situation in the area studied and it was well confirmed by the data records. This type of results was previously reported (DAE 2007; GKF 2002; MOA 2006) though its problem intensities were less severe.

Table 2. Technical activity as a part of remodeling prioritized by respondents

Parameter	Northern region	Western region	Southern region	Central region	Mean
Using shallow engine	52	62	53	47	43
Water recharge estimation	78	52	61	68	65
Water loss modeling	45	36	42	49	43
Conversion of energy source	43	36	29	40	39
Technical management of the plant	60	51	48	49	52
Others	17	18	29	31	24

Water recharge may be the main problem for low rate delivery of water by DTW followed by poor technical management of DTW sets which directly relates to the unplanned establishment of the DTW base creating barriers in percolation of water to the underground stream. The mean results as percent show that water recharge estimation scored 24% followed by technical management of the sets being 20%.

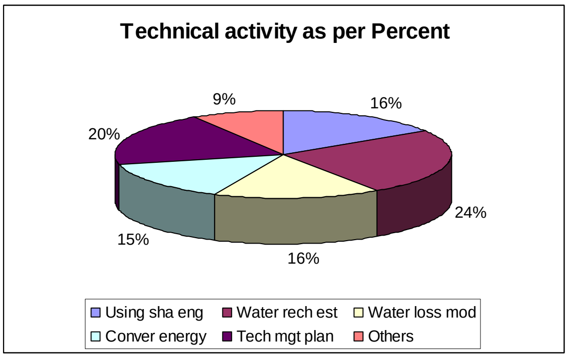

Fig. 3. Technical activities required for improvement

Operational Status and modeling elements

The on the operational or functional status of the DTW are given in the Table 3 and 4. The results indicate that lack of water in the peak/dry season was the main problem responded by 68% as a mean of all regions by for proper functioning of the sets, followed by causing damage of biodiversity being 76%. As a component elements required for the modeling were found to be the strong lining of the structure responded by 76% (mean of all regions) followed by i water soaking and recharging as 68%. I t may be due to drought effects to livestock and also wild lives and fishes, birds as previously noted by different researchers and development planners (Anon. 1987, 1994; BARC 2008).

Table 3. Functional status of equipment DTW and STW

Parameters	Northern region	Western region	Southern region	Central region	Mean
Lack of water in peak season	71	64	61	77	68
Water loosing in lean season	68	49	46	58	55
Damage of biodiversity	74	86	52	57	67
Degradation of public health	32	37	29	21	40
Decreased agric prod and increasing poverty	64	53	46	54	54
Others	17	15	19	21	18

Table 4. Component elements for DTW remodeling

Parameters	Northern region	Western region	Southern region	Central region	Mean
Minimum use of the TW and well	52	43	51	57	51
Strong lining of the structure	78	82	76	68	76
Increasing water soaking and recharging	84	56	62	69	68
Re-installation	32	37	29	36	33
Using metallic pipes	24	33	42	41	35
Others	27	25	19	23	23

The recommended for lining and water recharging in DTW

The following model has been recommended to improve the water delivery for irrigation and saving the environment reducing the damage of biodiversity for the areas studied. The model include 5-layer design as illustrated in the Fig. 4 to be constructed at the base of the DTW which will enhance water soaking and recharging of the ground water level. The respondent prioritized 17 × 13 meter base size for DTW followed by 15×10 meters according to the capacity of the DTW.

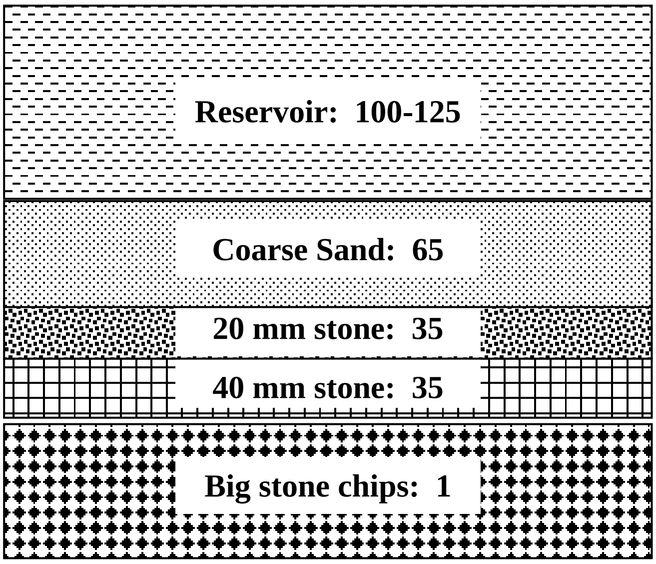

Fig. 4. Recommended 5-Layer Model for DTW water enhancing Model

CONCLUSION

The conductivity and specific storage of the aquifer in deeper strata is not so good for installation of production well having high capacity. Ground water condition is greatly improved by augmented recharged from surface water irrigation or from any sources like rain water. In order to investigate the potential aquifer in deeper strata its thickness as well as spatial extent and its properties, a sufficient number of test drilling and aquifer test are recommended to be performed. During and after irrigation the effects of ground water table should be assessed from time to time during the process of implementation and based on the actual impacts of the trend of water table fluctuation needs to be monitored to avoid adverse impacts on ecology ensuring proper spacing of DTW to avoid interference. Artificial recharge to improve ground water, specially in the northern region area is strongly recommended which experiences were taken in this study using the 5-layer base model as recommended here. It may increase water efficiency up to 20% involving an additional cost of 5-12%.

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