Global Scientific JOURNALS

GSJ: Volume 8, Issue 11, November 2020, Online: ISSN 2320-9186
www.globalscientificjournal.com

Underground uPVC Pipe Line System for Irrigation in BMDA : A Successful Case of Water Utilization in a Judicious Way.

Sumanta K.Basak*

Abstract

Agriculture is the major water using sector in Bangladesh and underground water and surface water bodies are very limited during August to May in every year due to low annual rainfall in the north-west region. This study used to review of the existing situation of irrigation water distribution, water use efficiency and appropriate water pricing in Barind agriculture. Efficient use of water for crop production is now often a major goal in designing and management of irrigation systems. An appropriate water application system should be developed and only by improving the performance of water application, effective water distribution systems and efficiency of water management in agriculture could save water from existing uses. Better management of irrigation water, water distribution system and appropriate water charging policy possibly will enhance greater efficiency in water use. This study suggests that the improved water distribution system as developed by BMDA is also sustainable by increasing productivity as a whole in irrigation sector of Bangladesh.

Key Words: uPVC Pipe Line, Irrigation Distribution System, Efficient Water Utilization, BMDA Irrigation.

Introduction

Agriculture is the major water using sector in Bangladesh and every year scarcity of irrigation water and severity of drought is seen in the northwest region during the dry season due to low annual rainfall. Agricultural water management in Bangladesh is an important issue for maximizing agriculture production.

Irrigation water is a prospective well-recognized system for increasing production. But application and management of this have been suffering in the rural areas specially in high Barind areas, thereby making the irrigated agriculture non-profitable or less profitable.

***Sumanta K. Basak, Executive Engineer, BMDA, Head Quarter, Rajshahi 6000. email: sumantabmda@gmail.com**

Proper land leveling and grading, selection of reliable source of water and its quality for irrigation, design and construction of efficient water distribution system and application of optimum quantity of water at the right time with maximum water distribution efficiency are some of the important aspects of irrigation management.

Irrigation comes from two major sources - surface and ground water. Groundwater has covered 73.44 percent of total irrigated area (BADC, 2019) and about 80 percent of groundwater was used for crop production in which Boro paddy consumed 73 percent (BBS, 2008) of total irrigation. More importantly, 75 percent of the total irrigation water has been used for paddy (rice) production. Most of the irrigation methods are traditional which caused of environmental degradation as well as extra cost of production. Groundwater abstraction has lowered water levels beyond the potential of natural recharge in urban and pre-urban areas.

As water and agriculture policy in Bangladesh is directed towards the following objectives: **a.** Encourage and promote continued development of minor irrigation, where feasible, without affecting drinking water supplies **b.** Encourage future groundwater development for irrigation by both the public and the private sectors, subject to regulations that may be prescribed by Government from time to time **c.** Improve efficiency of resource utilization through conjunctive use of all forms of surface water and groundwater for irrigation and urban water supply **d.** Strengthen crop diversification program for efficient water utilization **e.** Strengthen the regulatory system for agricultural chemicals that pollute ground and surface water, and develop control mechanism for reducing non-point pollution from agro-chemicals **f.** Strengthen appropriate monitoring organizations for tracking groundwater recharge, surface and groundwater use, and changes in surface and groundwater quality,

So, there is a call for upgrading irrigation technology in which can bring well-being to the majority of farmers. This paper describes the development process of modern irrigation technology in respect to water saving and management of water resources in Bangladesh. The focus is also given on uPVC pipe line in irrigation system in Barind area.

A Review to Objectives

Bangladesh agriculture is still rice based and rice is the staple food of 90 percent population. This component provides 96 percent of the countries' food requirement and employees about 60 per cent of labor force (Alam, 2008). Hence, most of the technological advancement attained concerning to

increase food grain (rice) production. Rightly, country achieved at marginal self-sufficiency on food grain production with the cost of indiscriminate use of natural resources particularly water resources. Thus, this is the best time to pay attention on sustainable water management with the help of modern technology.

However, the excessive groundwater abstraction for traditional irrigation (flooded irrigation) has posed a great challenge to the rural drinking water supply using hand-operated tube-wells. The presence of arsenic has further worsened the situation. In urban and pre-urban areas, groundwater abstraction has lowered water levels beyond the potential of natural recharge (Zahid, 2006). The demand for both surface and groundwater for irrigation is on the rise in the dry winter season which is 58.60 percent of total demand for water. The principal crop during this season is boro rice, occupying about 70 percent of crop production uses up a lot of water in the production process compared to wheat or potato. According to one estimate of Biswas and Mandal (1993), the quantity is 11, 500 m3 per hectare (ha). In contrast, water saving technologies are being used by some commercial farms which need to be disseminated to the masses of farmers.

Most studies in efficiency of input use in the literature are based on production function estimates. Production functions assume specific field application efficiency. All estimates regardless of the methods to derive them depend on assumptions about the technology, or efficiency of the irrigation system. Irrigation water efficiency increases with a rise in crop price and an improvement in irrigation efficiency. Irrigated area has increased by 16 to 56 percent in the last three decades (due to technological advancement) but irrigation coverage was not equally distributed all over the country. Different topography, availability of modern irrigation technology and socio-economic status of the farmers has considered such unequal distribution (Rahman, 2009).

In the Bangladesh context to date there has been no study testing the allocate efficiency of input use in agriculture. Previous studies are based on absolute efficiency. Chowdhury (2005) found high economic value of water in southwest, southeast and northwest regions of Bangladesh. In the developing country context one study was done by LINDE-RAHR (2005) who tested the relative efficiency of input use in Vietnamese agriculture.

Most studies in efficiency of input use in the literature are based on production function estimates. Irrigation water efficiency increases with a rise in crop price and an improvement in irrigation efficiency. The studies done in Indian agriculture measures the absolute efficiency of

water use but the methodology used is quite dated (VAIDYANATHAN, 2004). The developed world has been enjoying the benefits of modern innovation of the agricultural sciences (Zaman, 2006). Bangladesh is still lagging behind, needs to exploit the benefits of science more than anything.

Barind areas specially high Barind tract is facing this problem. Thus determining the actual crop water requirement and crop water use distribution efficiencies, the optimum and economic use of water can be assured by an irrigation engineer. For designing and managing irrigation, the government of Bangladesh has emphasized the irrigation development in the country as one of the major issues for attaining self-sufficiency in food by increasing production.

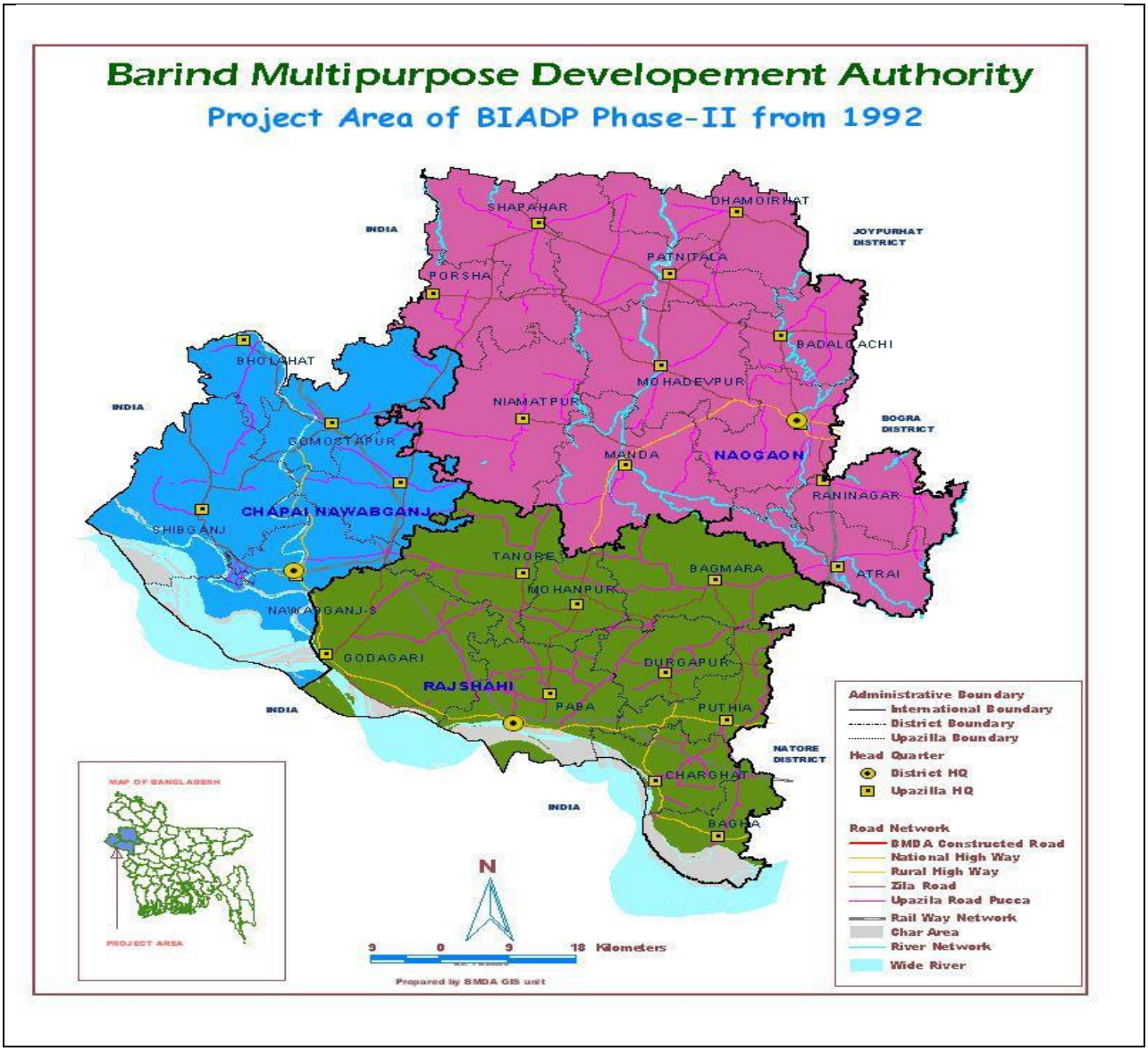
Location, Soil and Crops and Climatic Conditions

Rajshahi Barind (Rajshahi, Chapai Nawabganj and Naogaon districts) is located in between 24°23' to 25°15' north latitude and 88°02' to 88°57' east longitude. Total cultivable land of 5.75 lac hectare, out of which 5.11 lac hectares of land has brought under controlled irrigation. Irrigated area through BMDA's DTW is 2.85 lac hectares (BADC, 2019). There are three types of land in respect of topography-high land (47%), medium land (38%) and low lying area (15%) (BMDA,2005). In high Barind area, there are about 80% lands terraced or undulated. Boro(Rice) crops are being the major cereals in where irrigation demand is very high. Paddy, wheat, maize, potato, mustard, pulses, sugarcane etc. are the major crops grown in this area.

The climate of Rajshahi Barind is extreme in both summer and winter. A typical dry climate with comparatively high temperature prevails in Barind area except for the wet season beginning from mid-June to October.

Rainfall in the area varies from about 1500 mm to 2000 mm. Temperature ranges from 4° Celsius to 44° Celsius and relative humidity is about 78%. Out of total cultivable land, 34% is loamy, 10% is sandy, 49% is clayey soil and the rest of 7% is other types of soil according to the soil classification as reported by BBS (Bangladesh Bureau of Statistics). The elevation above MSL(Mean Sea Level) ranges from 12 m to 46 m (Gomostapur of Chapai Nawabganj district) (BMDA, 2005).

An area map is shown bellow:



Irrigation Water Distribution Systems of BMDA

BMDA has developed low cost channels for the improvement water distribution system since 1992. The channels are better than traditional earthen channel especially in respect to efficiency and cost. Different types of channel with various construction materials have been tried to the field for improvement in water distribution system for better management of irrigation. The operational cost of traditional earthen channel has become a burden to the farmers unless the command area is large. The conveyance efficiency of traditional earthen channel is 50-55% and

water loss rate 40-45% (BARI, 2007). In consideration with high water loss, BMDA has developed four major distribution systems to reduce water loss from the beginning:

(a) Lined open channel: Constructed with Brick in rectangular shape,

(b) Lined open channel: Constructed with Ferro-cement semicircular type,

(c) Buried pipe irrigation: using CC pipe,

(d) Buried pipe irrigation: using uPVC pipe. Now three earlier and back dated systems (a, b and c) has been replaced by uPVC pipe irrigation system in BMDA.

Earthen channels- At the early stage, BMDA installed deep tube wells with earthen channels for irrigation water distribution system. Farmers had to construct those channels to divert water to their crop lands. Conveyance loss was very high (about 40%–50%) resulting irrigation cost higher. Besides these, seasonal construction and repair of earthen water flow uncertain and untimely for social involvement in some cases. A research conducted in Godagari upazila shows that the conveyance efficiency in an earth canal is 58.66 % (Rahman et al. 2011).

Lined surface canals- To avoid conveyance loss and to improve irrigation efficiency by lined surface channels like i) brick built and cement concrete, or ii) ferro cement channels have been constructed by BMDA. Such surface channel construction needs some land of the farmers which is very costly and problematic.

Again these lined surface channels were difficult to construct with its alignment in straight due to farmers fragmented land separated in ails which causes higher cost. Also regular maintenance of these types of canals is an issue of financial burden.

Buried pipe line- The critical topography of the north specially of the high Barind area, where land is undulated, led to the approach towards buried pipe line for irrigation systems. This system permits irrigation water to any desired high place. In this system, water is conveyed through underground cement concrete (cc) pipe lines to the crop fields, resulting no land loss. In BMDA in the early stage, cement concrete buried pipe lines were built.

Presently, bringing more sophistication in the construction, aiming to minimize irrigation water conveyance loss to zero level, uPVC buried pipe line construction is being practiced. By this system irrigation water can be made available very near to the farmers' plot most efficiently.

Laying of uPVC pipe in an Irrigation Scheme.

Conveyance Efficiency and Water Loss in different type of soils in Barind area is shown in table bellow:

Soil Type	Studied Area (Upazila and District)	Types of Irrigation Distribution System	Average Conveyance Efficiency (%)	Average Water Loss (%)	Remarks
Clayey	Godagari, Tanore of Rajhhahi district & Porsha of Naogaon district.	uPVC pipe line	94.50	5.75	High Barind area
Loamy	Paba, Mohanpur of Rajshahi district & Manda of Naogaon district.	uPVC pipe line	93.53	7.40	
Sandy	Durgapur, Puthia upazila of Rajshahi district.	uPVC pipe line	92.20	8.05	

The result shows that the conveyance efficiency of irrigation water distribution system using uPVC pipe line is increased about 49.50 % in clayey soil, 48.53 % in loamy soil and 47.20 % in sandy soil in respect to earthen channel respectively. The results are also much more better than lined brick and fero-cement channels. In these two channels, there is an over flow problem that occurs, because in majority cases land leveling and slope cannot maintain due to some social problems. Some irrigable land also used for channel construction.

Underground uPVC irrigation system is more suitable for the farmers due to very limited hazards. There is no way to waste irrigation water, if there are no construction fault and management difficulties. The losses occur only for loose and inappropriate jointing of uPVC pipes between male and female parts. Some problem arises in the tertiary earthen channels. There are some problems arise on the outlet joints.

Conclusion

All farmers and Water User Associations in Barind area are positive for introduction of improved water distribution system like uPVC underground irrigation pipe line system. According to them, development of this technology is very appropriate in Bangladesh context. Majority of farmers opined that irrigation water distribution channel of irrigation schemes should be constructed with uPVC pipe. It is the most suitable water distribution system in Barind area. This system could be widely used and recognized as a model of irrigation water distribution system for increasing agricultural production in Bangladesh.

References

1. Alam, M.S M. R Islam, M.A Jabber , M.S Islam and MA Salam (2008). Institutional Backup Towards Food Security in Bangladesh, in proceedings BKAS 13th National conference and seminar on Climate Changes: Food Security in Bangladesh, vol. 13, Dhaka, Bangladesh August 2008.
2. BADC, 2019. Minor irrigation survey report: 2017-18. Bangladesh Agricultural Development Corporation. Sech Bhaban, Dhaka 1207.
3. BARI (2007). Annual Report of Bangladesh Agricultural Research Institute, BARI, Dhaka, Bangladesh.

4. Bangladesh Bureau of Statistics (2008). Statistical Year Book of Bangladesh, Bangladesh Bureau of Statistics, Statistics Division, Ministry of planning, Government of People's Republic of Bangladesh, Dhaka, (http://www.bbs.gov.bd/agriculture_wing /annual_agri_stat.pdf).
5. BMDA, 2005. DPP for Barind rain water conservation and irrigation project. August 2005.
6. BISWAS, M.R. and M.A.S. MANDAL (1993): Irrigation Management for Crop Diversification in Bangladesh. University Press Limited, Dhaka, Bangladesh.
7. CHOWDHURY, N.T. (2005): The Economic Value of Water in the Ganges-Brahmaputra-Meghna River Basin. Beijer Discussion Paper 202, October 2005. Beijer International Institute of Ecological Economics, the Royal Swedish Academy of Sciences, Stockholm, Sweden. Available at www.beijer.kva.se/publications/pdf-archive/Disc202.pdf.
8. LINDE-RAHR, M. (2005): Differences in agricultural returns: an empirical test of efficiency in factor input allocation using Vietnamese data. In: Agricultural Economics 32: 35-45.
9. Rahman et al. 2011. Study on the irrigation water distribution system developed by Barind Multipurpose Development Authority. J of the Bangladesh Association of Young Researchers(JBAYR). Vol.1, No. 2, June 2011, pp: 63-71.
10. Rahman, M.W (2009). Ground water irrigation and food security in Bangladesh: an evidence of last three decades, paper accepted for publication to the Journal of Water resources and Protection, Vol-1(2).
11. VAIDYANATHAN, A. (2004): Efficiency of Water Use in Agriculture. In: Economic and Political Weekly: 2989-2996.
12. Zahid, A. Ahmed, S.R.U “Groundwater Resources Development in Bangladesh: Contribution to irrigation for Food Security and Constraints to Sustainability”, Groundwater Governance in Asia Series-1, pp25-46, 2006.
13. Zaman, M (2006). Breakthrough in Growing Food, Cover story, Star weekend Magazine, Vol. 5 (102) July, 2006.