Scientific Journal of Impact Factor (SJIF): 5.71

e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 6, Issue 03, March -2019

EFFECT OF IRRIGATION SYSTEM ON AGRICULTURAL LAND

(A CASE STUDY OF KOHAT, PAKISTAN)

Bakht Niaz Khan[1], Junaid Ur Rehman[2]

[1]*M.Sc. Scholar, Department of National Institute of Urban Infrastructure Planning, University of Engineering & Technology Peshawar, Pakistan*
[2]*M.Sc. Scholar, Department of Water Resources Engineering, University of Engineering & Technology Peshawar, Pakistan*

Abstract: *The purpose of this research is to find the condition of the existing irrigation system and its impact on the agricultural production and cropping intensity of Kohat District. The condition of the existing irrigation system was surveyed in detail. According to the observation carried out, it was concluded that, the design discharge of the existing outlets "pipe outlets of non-modular" type is not appropriate, therefore, Open Flume Outlets (OFM) were proposed for the research area. The existing condition of the canal and distributaries were also studied. The irrigation system was proposed to be remodeled in order to increase the agricultural productivity.*

Key words: *Irrigation system, Cropping intensity, Design discharge, Non-modular, agricultural productivity.*

1. INTRODUCTION

Irrigation system impacts the production of the agrarian part. The government task of water system frameworks is vital viewpoint in the achievement of crop yields. The motivation behind this research is to consider learning and examinations that distinguish the key criteria and procedures to work the irrigation system for advance production. The effectiveness of water system primarily depends on management and layout of the system according to the land requirement. Designing of irrigation system effects on application efficiency and involves many variables and restrictions, whose key objective is to increase benefits and minimize application costs. In a well-organized efficient irrigation system, a set of assists produces maximum benefits. To attain this, a balanced process promoting the design and operation of application systems in agriculture is needed due to many feasible combinations of design variables that satisfy irrigation requirements.

Proper administration of the existing water at farm level is required because of increasing need, finite resources, ground water table change in space and time, and problematic soils [1]. Proper water irrigation management at farm is one of the basic sources in beneficial operation and management of irrigation system. A dynamic and efficient irrigation schedule requires the authentic determination of water need for the crops to help the farmers to decide irrigation numbers and time of irrigation.

Use of Irrigation systems varies on based in several factors, which the most beneficial for crop, soil, topography, water sources and its quality. The application efficiency of different irrigation methods alter and depend on its designing, management practices, and operational methods [2].

Technologies in irrigation systems at field level depend on the water availability, climate distribution, type of crop and soil, the social and economic circumstances, and the distribution system [3].

1.1 Existing irrigation system:

The existing canal irrigation system consists of main canal, distributaries, minor and water courses throughout the project area. The design capacity of main canal system was 215 cusecs having free board of about 1.5-2 feet. The existing canal system is in poor condition having disposition of silts, mud and garbage near city area. The de-silting is unusual and the main canal and distributaries has been broken and need proper remodeling/repair and maintenance of the conveyance system.

The existing tertiary canal systems; includes main water courses and lateral water course (field level channels). The total length of existing watercourses is about 1,047,587m**,** out of which about 5% (52,380m) are lined and the remaining unlined. The unlined watercourses are also silted up with breached in banks and weeds growth problems. The conveyance system, the water is missing through leakage from the clay beds and arrays of the channels, over topping due to inappropriate banks sedimentation due to movable flows. Similarly, water is missing within the ground during use due to furrow thereby subsequent in over irrigation or below irrigation [4].

The farmers almost lack basic knowledge of the crop water need and over or under-irrigation for the crops is, therefore, a communal practice. There is a large potential of saving water through lining of earthen channels and proper leveling of fields. It will have direct impact on improving water productivity in the command areas.

In the exiting irrigation system 164 outlets are working for distribution of water from supply canal to tertiary system. Majority of them are pipe non-modular types that do not draw their proportional discharge and are easily tampered.

Further the discharge is affected with water level both in canal and watercourse. The other disadvantage of this outlet is that it draws more water than its design both in full supply and low supply levels. As a result the tail users could not receive their due share of water. The shortage of water at the tail of the command area is due to the following reasons.

- The farmers are cultivating their land without consultation with Agriculture Extension department;
- Growing crops requiring high delta of water;
- Issues in Operational management of Dam.

1.2 Cropping Pattern of The Study Area:

The project area has two cropping seasons which are Rabi and Kharif crops. The Rabi crops include wheat, Melon and Rabi vegetables which are seeded in the winter or during start of summer and reaped in the end of summer. The Kharif yields include fodder, mung bean, sorghum, maize, vegetables and rice. Farmers have established numerous cropping patterns to cope with the precarious situations that are important part of irrigation [5], [6].

2. METHODOLOGY

2.1 Study area:

The study area for this research was District Kohat. It is found in Khyber Pakhtunkhwa, Pakistan. It is located 33.58 latitude and 71.45 longitudes and it is situated at elevation 503 meters above sea level. Kohat has a population of 151,427 making it the 4th biggest city in Khyber Pakhtunkhwa. The area is mainly irrigated with Tanda dam.

2.2 Redesign of discharge outlets:

Most of the existing **164** outlets are **pipe outlets of non-modular** types, their discharge totally depends upon the level of the water in the canal and watercourse.

According to the analysis carried out, the discharge from the outlet is not proportionate at low and full supply levels. The existing irrigation system has uneven outlets distribution. Similarly during the different flow regimes the outlet draws more water than required with subsequent shortfalls in the tail reaches. In order to distribute water equally to lower units with full and minimum supply level in the parent canal **Open Flume Outlets (OFM)** are proposed.

The location of the outlet from the parent canal was selected based on the highest ground in the command area. The width of the outlet has based on water allowance of **129** acres per cusec, with minimum throat width of **6** cm. A total of **101** outlets have been proposed.

The procedure given in the FAO Irrigation and Drainage Paper 26/1 titled “small hydraulic structures” publication has been adopted for the design of open flume outlets.

A flared upstream head wall and a progressively increasing flume, is provided near the outfall to get the full recovery at the head. The length of the throat should be equal to **2H** and the controlling section starts at a distance of **2H** from the toe of the side slope of the supply canal. In order to obtain the maximum recovery of head, the downstream side walls are splayed at **1: 10** for a length of **1.5 m**.

The design formula used for an open flume outlet is

$$Q = C\ Bt\ H^{2/3}$$

where

Q = design discharge of the outlet in Cumec;

$\mathbf{B_t}$ = It represents the width of throat in the cm (Minimum throat width is **6** cm);

H = height of the designed full supply level in the parent canal above the level of the crest in the outlet in cm;

C = a coefficient having the following values for different widths of throat are given in the table.

$B_{(t)}$ (cm)	C
6 to 9.0	0.0160
9.1 to 12.0	0.0163
Over 12.0	0.0166

Table 1: Coefficient values

The minimum recommended throat width of a proportional outlet is **6-cm** for practical consideration like growth of weeds, plugging of outlet from debris and solid waste etc.

Figure 1 Kohat branch canal which irrigate the area

3. RESULTS

The existing cropping intensity is only **66%** due to unavailability of water for irrigation at tail area and for additional command area due to silting issue of dam which has decreased its storage capacity from 96.21 MCM (78,000 acre feet) to 61.08 MCM (49,523 acre feet). The existing cropping pattern comprises mix orchards, maize, Kharif vegetables, Rabi vegetables, melon and wheat etc.

3.1 Improvement of Existing Watercourses:

To minimize losses about 157,138m of the existing watercourses will be lined with parabolic segments. The remaining unlined sections will be remodeled/ re-sectioned to trapezoidal sections including the installation of farm turnouts to distribute water efficiently. The following scope of work for the improvement of water courses has been envisaged.

S. No.	Description	Unit	Quantity
1	Outlets	No.	91
2	Main Water Course to be Lined	Length (m)	157,138
3	Water Course Repair Maintenance	Length (m)	765,491
4	Road Crossing	No.	20
5	Naccas/ Farm Turnout	No.	2364

Table 2 shows improvement of existing water courses

3.2 Remodelling of Irrigation System

De-siltation is proposed in all silted up sections of irrigation system, while lining and repair of damaged portions of the canals are proposed. The side walls of some of the structures and few stretches of channels are also proposed to be raised. Similarly, the side berms of the canals are proposed to be formed in almost all of the canals where required throughout their length. Total remodeling involves a length of 37,501m.

3.3 Resign of outlets:

The discharge outlets are reduced from **164** to **101** at different locations, in order to supply the water according to demand and requirements. The **pipe outlets of non-modular** types were proposed to be changes to **Open Flume Outlets (OFM)** to achieve full supply at any level in parent canal.

S/No.	Canal Name	Exiting Outlets	Proposed Outlets
1	Main Canal	2	2
2	Suleman Branch	14	3
3	Kamar Dhand Disty	13	9
4	Chambi Disty	6	4
5	Chambi Minor	2	2
6	Kohat Branch	9	3
7	Fateh Khan Banda Minor	5	4
8	Ditch Minor	3	2
9	Jerma Minor	14	8
10	Jerma Sub Minor	6	4
11	Kharmatu Disty	16	12
12	Baqi Zai Minor	4	2
13	Kharmatu Minor	7	5
14	Bura Ghari Minor	5	6
15	Gandialy Disty	27	10
16	Bahadu Kot Minor	3	3
17	Togh Bala Minor	3	3
18	Togh Payan Minor	7	6
19	Babri Banda Minor	13	7
20	Malak Jan Minor	5	6
TOTAL		164	101

Table 3 Illustration of Design outlets

S. No	Description	1968	2016
Main Tanda Dam which supply water for irrigation			
1	Gross Storage	78000 Acre-ft.	47990 Acre-ft.
2	Live Storage	64750 Acre-ft.	46919.5 Acre-ft.
3	Dead Storage	13250 Acre-ft.	1070.5 Acre-ft.
Irrigation System			
4	Length	82 km	83.9 km
5	Full supply Release	215 Cusec	215 Cusec

Table 4 Comparison between 1968 and 2016

4. CONCLUSIONS

This paper shows the effect of improper irrigation system on agricultural productivity. The cropping intensity of the research area is **66%.** The discharge outlets were redesigned from **pipe outlets of non-modular** types to **Open Flume Outlets (OFM)** to achieve full supply and to supply water to tail of the farm. The uncultivated land will become cultivable through this way. Moreover, the existing damaged portions of the canals are proposed to be lined and repaired. Similarly, about **157,138m** of the existing watercourses will be lined with parabolic segments to minimize water losses. De-siltation of the Dam will improve the irrigation system under research area.

REFERENCES

[1] Gupta, P. K., Rustgi, S., Sharma, S., Singh, R., Kumar, N., & Balyan, H. S. (2003). Transferable EST-SSR markers for the study of polymorphism and genetic diversity in bread wheat. Molecular genetics and genomics, 270(4), 315-323.

[2] Bardowicks, K., Trautmann, N., Arumí, J. L., Billib, M., & Holzapfel, E. (2006). Simulation of Nitrate Losses using HYDRUS 2D. In Proceedings Int. Conference on Agricultural Engineering in a Globalized World, V CIACH, Chillán, Chile, 10.-12.05.
[3] Playán, E., & Mateos, L. (2006). Modernization and optimization of irrigation systems to increase water productivity. Agricultural water management, 80(1-3), 100-116.
[4] Merriam, J. L., Shearer, M. N., & Burt, C. M. (1980). Evaluating irrigation systems and practices. Evaluating irrigation systems and practices., 721-760.
[5] Levy, V. (1985). Cropping pattern, mechanization, child labor, and fertility behavior in a farming economy: Rural Egypt. Economic Development and Cultural Change, 33(4), 777-791.
[6] Levy, V. (1985). Cropping pattern, mechanization, child labor, and fertility behavior in a farming economy: Rural Egypt. Economic Development and Cultural Change, 33(4), 777-791.

