A CASE STUDY ON THE SEWAGE TREATMENT PLANT IN A PRESCRIBED LOCALITY

Mrs.Chinthiya
Sr.Lecturer, Department of Civil Engineering
GEMS Polytechnic College, Aurangabad,Bihar-824121,India.
chinthiya@gemspolytechnic.edu.in

Daniel Swami
Senior Lecturer, Department of Civil Engineering,
GEMS Polytechnic College, Aurangabad, Bihar-824121, India.
daniel@gemspolytechnic.edu.in

Avinash kumar singh, Aman kumar, Deepshikha, Shristi kumari
Final year students, Department of Engineering,
Gems Polytechnic College, Aurangabad,Bihar-824121, India.

Abstract—Crop production is a common agricultural practice followed by world and produces crops to use as food and fiber. This practice includes all the feed sources that are required to maintain and produce crops. Listed below are few practices is used during crop production. The ultimate stages of crop production are harvesting and storage. Harvesting requires art and practice because a large proportion of crops can be lost due to improper methods of harvesting. Another concern besides harvesting is storage. Storage of grains is to be given utmost priority as improper storage can result in the destruction of crops being by pests or unfavorable environmental conditions. Irrigation is the process of applying water to the crops artificially to fulfill their requirements. Nutrients may also be provided to the crops through irrigation. The various sources of water for irrigation are wells, ponds, lakes, canals, tube-wells and even dams. Crop yields are harvested production per unit of harvested area for crop products. In most of the cases yield data are nor recorded, but are obtained by dividing the production data by the data on area harvested. The gross command area (GCA) includes cultivable land as well as barren land, forests, houses, wasteland, roads etc., cultivable command area is that part of gross command area, which is fit for cultivating crops. So, cultivable area excludes forest and barren land from the gross command area.

Keywords— Gross command Area (GCA), harvesting and storage, cultivable land

I. Introduction

Location, Area, and Administrative Details

Aurangabad is one of the districts in Bihar. It is one of the 5 districts of Magadh division. The head quarter of the district is Aurangabad. The district with a geographical area of 3389 Km2 between the longitudes of 840 00' – 840 45' E and the latitudes of 240 30' – 250 15' N is located in the South Bihar Plains (SBP) and constitute a part of the marginal alluvial plains of Ganga Basin. The Sone River forms the western boundary of the district and at the southern boundary lays the Chhota Nagpur Granitic Complex (CGGC) of Jharkhand state, which forms apart of the peninsula India (Fig 1). The district is bounded in the north and the east by the Arwal district and the Gaya district respectively.

The district has two sub-divisions namely Aurangabad and Daud Nagar and 11 blocks, namely Madanpur, Kutumba, Daud Nagar, Aurangabad, Barun, Obra, Deo, Nabinagar, Haspura, Goh and Rafiganj (Table 1). There is total 224 Gram Panchayats covering 1712 villages in the district.

Vol.11, No.1, 2023, DOI- 10.18486/ijcsnt.2023.11.1.15

S. No.	Block	Panchayats	Villages	Habitations
1	Aurangabad	15	154	279
2	Barun	18	182	261
3	Daud Nagar	17	56	137
4	Deo	20	118	264
5	Goh	20	163	235
6	Haspura	20	71	196
7	Kutumba	23	215	238
8	Madanpur	19	117	350
9	Nabi Nagar	27	284	426
10	Obra	21	144	305
11	Rafiganj	24	208	386
	Total	224	1712	3077

Table 1: Details of administrative units.

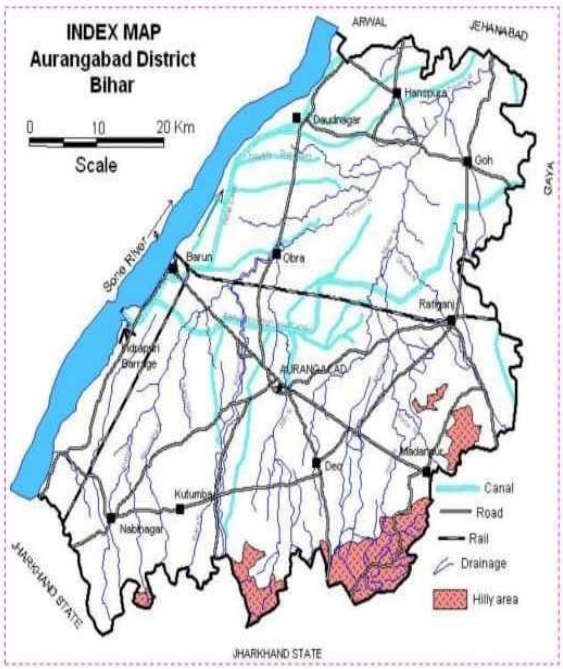

Figure 1: The map of Aurangabad district with administrative details.

In 2011, Aurangabad had population of 2540073 (Population Census 2011) of which male and female were 1,318,684 and 1,221,389respectively. The rural population constitutes ~90% of the total population (Table 2). There was change of 24.75 percent in the population compared to population as per 2001. The initial provisional data suggest a density of 769 in 2011 compared to 609 of 2001. Average literacy rate of Aurangabad in 2011 were 70.32. With regards to Sex Ratio in Aurangabad, it stood at 926 per 1000 male compared.

Actual Population	2,013,055	2,540,073
Male	1,040,945	1,318,684
Female	972110	1,221,389
Population Growth	30.19%	26.18%
Area Sq. Km	3305	3305
Density/Km^2	609	769
Proportion to Bihar Population	2.43%	2.44%
Sex Ratio (Per 1000)	934	926
Child Sex Ratio (0-6 Age)	943	944
Average Literacy	57.03	70.32
Male Literacy	71.13	80.11
Female Literacy	41.90	59.71
Literates	920,766	1,466,002
Male Literates	594,522	868,733
Female Literates	326,244	597,269

Basin /Sub-Basin and Drainage

The Aurangabad district falls in the Punpun River Sub-basin. The craton-origin Punpun River is a 3rd order stream, forming a southern tributary of the Ganga River. It forms the major drainage and the entire Aurangabad district falls in the watershed of the river. There are other drainages namely Batane, Batre, Adri, Ramrekha, Kasman, Madar, Dhawa etc, which merge with Punpun at different points within the district and the trunk river flows out of the district as a single thread (Fig 1). Major stretches of the river seem to follow the paleochannel of Sone. The river in its northern stretches is highly incised and often braided. The north-western peripheral part is drained by the river Sone, flowing from south-west to north-east. Though, the Sone and the Punpun bear little flow during non-monsoon periods, most of the other streams in the district remain almost dry during the same period.

WATER USE HABITS

People of Aurangabad district depend on groundwater for their drinking need, except few urban areas, which get the water supply from nearby rivers, i.e., a part of the drinking need of Aurangabad town is met from the Batane River due to lack of any potential aquifer beneath the town. Earlier, people used to depend on dug wells/dug-cum-bore wells to tap groundwater. Minor Irrigation Census of 1993-94 for the state of Bihar reported 9056 of such groundwater abstraction structures to exist in the district such structures is in a decline phase and the MI Census of 2001 reports only 4759 of such

Vol.11, No.1, 2023, DOI- 10.18486/ijcsnt.2023.11.1.15

structures. Hand/machine driven tube wells fitted with hand pumps have been popular in the district due to shallow water level in major parts.

However, the use of People depend on supply of water from the barrage on Sone River at Indra Puri for irrigation. Available surface water in streams and ponds are also used for irrigation during the dry period.

AGRICULTURE AND IRRIGATION PRACTICES

The people of the district depend on agriculture for their livelihood and sustenance. Rice and wheat are the staple crops. Besides, mustard, vegetables and dal are richly cultivated, specifically in the southern parts of the district. The north-western parts of the district covering the blocks such as Barun, Obra, Daudnagar, Goh and Hanspura get East Sone Canal water for irrigation. Though, there is a culture of triple harvesting a year in the districts.

Plate 1: Rich rice cultivation in Aurangabad district during the summer. **Plate 2:**

(a) Photo of barrage on Sone River at Indrapuri. The Eastern Canal System from barrage provides irrigation water in parts of western South Bihar Plains

(b) Canal water in Aurangabad and irrigation for winter paddy and Dal

In the southern parts of the district, the hand driven bore wells range in depth from <10m bgl to 30-35m bgl. Though, these bore wells fitted with hand pumps yield sufficient water for drinking, they are not potential to meet the irrigation need. Mechanically drilled bore wells go deeper in the hard rock to tap fracture zones and often yield enough water for irrigation. For instance, a tube well of 40m depth, constructed in the weathered/fracture zones run throughout the day with a 5HP pump fitted in it, delivering a discharge of5-7 litres per second (lps). The rivers such as Punpun, Barane, Adri, Ramrakha, Kasman, Dhawa and other small streams form the lifeline for the farmers, without which, large tracts of farm lands would go dry during the non-rainy days. Very often people use diesel

Vol.11, No.1, 2023, DOI- 10.18486/ijcsnt.2023.11.1.15

operated pump sets to lift water from the surface water sources such as rivers/nala/ponds. Specifically, winter crops (Paddy, Dal, Mustard, Jute etc.) get a major help from these rivers.

Plate 3: Lift irrigation from streams/rivers in Aurangabad district.

Plate 4:

(a) Small barrage on the river Kasma, from which a small canal (also known asPyne) goes for irrigation.

(b) Check dam on the river Ram Rekha on way from Amba to Deo, still makes a small reservoir in the month of February,assuring irrigation for the adjoining agricultural lands.

Since, majority parts of the district, particularly the northern and central parts, remain under shallow water level condition (2-8 m bgl), earlier, people used to irrigate small patches of Agri-fields through dug wells. Rehat is an old system of lifting water from the dug wells through a series of buckets attached with a rope,which remains fitted with one pulley. Such systems are found along the rivers asmentioned above, where the dug well remain connected with the river water. Animals were used to run the pulley. However, such systems in the district haveeither been obsolete or abandoned due to decrease in the flow in the streams/Nalas. Latha-kudi is another traditional process of drawing water manually from the dug well using a single bucket.

Plate 5:

(a) Photograph showing electric operated diesel pump drawing water from the dug

(b) Water transported to long distancefor irrigation- from bore well fitted with pump.

Plate 6: Rehat system for groundwater irrigation from dug well(at Amba) in Aurangabad district in the South Bihar Plain.

Plate 7: A small Arar in Kutumbablock of Aurangabad district.

II. METHODOLOGY:

A. Ahar-Pyne System of Irrigation

Ahar-Pyne system is an indigenous surface water irrigation technology of South Bihar Plains (SBP), which continues to irrigate substantial

Vol.11, No.1, 2023, DOI- 10.18486/ijcsnt.2023.11.1.15

areas even today in the region. High slope of land surface (~1.0 m/Km) is favourable for its success in SBP. An Ahar resembles a rectangular catchment basin with embankments on three sides. These structures serve to accumulate the flood water/surface run-off during monsoon. Pynes are artificial channels constructed from rivers to divert water for irrigation. These are often connected to the Ahars for assuring supply of water to it. Ahar was sometimes built at the end of small rivulets or artificial channels called Pynes to ensure the supply of water. These structures augment artificial recharge in the region.

In the Aurangabad district, a total of 1251 Ahar and Pyne structures are operational for the purpose of irrigation. These are traditional system of surface water irrigation in the SBP.

B. CLIMATE AND RAINFALL

A warm and humid climate embraces the area. 175 The summer (March–June) is hot with mean maximum temperature during June (peak summer) as 36.60C. A dry and cold winter (October to February) records mean minimum temperature as 9.20C in January. Humidity varies from 24.7% to 83.45% (Govt. of Bihar 1994). The districts in the SBP fall in the South Agro-Climatic Zones of Bihar and the annual rainfall in this area varies within 990-1300 mm. 88% of this rainfall comes during the southwest monsoon (June to September). The months July and August register peak rainfall in a year . The last decade rainfall distribution indicates alternate peaks and troughs in rainfall.

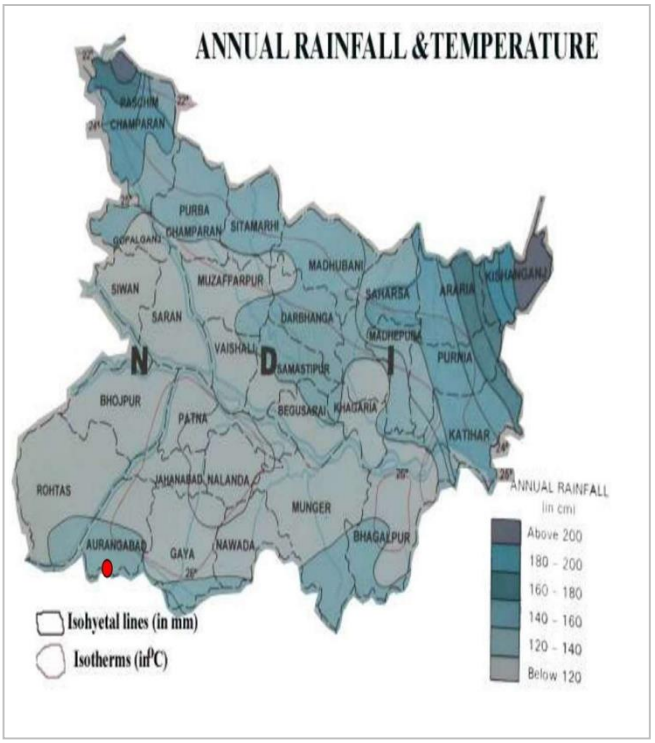

Figure 2: Annual Rainfall and Temperature

Source of Agricultural Productivity

Productivity is driven by changes in either agricultural technique or improvements in technology. Some sources of changes in agricultural productivity have included:

1. Mechanization
2. High yield varieties, which were the basis of the Green Revolution
3. Fertilizers: Primary plant nutrients: nitrogen, phosphorous and potassium and secondary nutrients such as sulphur, zinc, copper, manganese, calcium, magnesium, and molybdenum on deficient soil
4. Education in management and entrepreneurial techniques to decrease fixed and variable costs and optimise manpower
5. Liming of acid soils to raise pH and to provide calcium and magnesium
6. Irrigation
7. Herbicides
8. Genetic engineering
9. Pesticides
10. Increased plant density
11. Animal feed made more digestible by processing
12. Keeping animals indoors in cold weather

III. Impact

The productivity of a region's farms is important for many-reasons. Aside from providing more

Vol.11, No.1, 2023, DOI- 10.18486/ijcsnt.2023.11.1.15

food, increasing the productivity of farms affects the region's prospects for growth and competitiveness on the agricultural market, income distribution and savings, and labour migration. An increase in a region's agricultural productivity implies a more efficient distribution of scarce resources. As farmers adopt new techniques and differences, the more productive farmers benefit from an increase in their welfare while farmers who are not productive enough will exit the market to seek success elsewhere.As a region's farms become more productive, its comparative advantage in agricultural products increases, which means that it can produce these products at a lower opportunity cost than can other regions. Therefore, the region becomes more competitive on the world market, which means that it can attract more consumers since they are able to buy more of the products offered for the same amount of money. As productivity improvement leads to falling food prices, this automatically leads to increases in real income elsewhere.

VI. Conclusion

Creating a cropping pattern for an irrigation project involves several considerations such as soil type, climate, water availability, and market demand.

1. **Understand the Soil and Climate:** Evaluate soil type, its fertility, drainage, and moisture retention capabilities. Consider the climate conditions - temperature, rainfall patterns, and any seasonal variations.
2. **Water Availability:** Assess the water supply for irrigation. Determine the availability of water sources, their reliability, and the irrigation methods feasible for your area (drip, sprinkler, etc.).
3. **Crop Suitability:** Identify crops that thrive in your area's conditions. Some crops might require more water or specific soil types. Choose a mix of crops that complement each other in terms of growth cycle, nutrient needs, and market demand.
4. **Crop Rotation:** Plan a rotation system to maintain soil fertility and prevent pests and diseases. Rotate crops that have different nutrient needs and growth cycles to maximize yield and minimize soil depletion.
5. **Market Demand and Profitability:** Consider market trends and demand for various crops. It's essential to grow crops that not only suit the environment but also have a good market value to ensure profitability.
6. **CCA (Coefficient of Cultivation Advantage) and GCA (Gross Cultivated Area):** Measure the advantages of different cropping patterns in terms of CCA and GCA. Compare different patterns and select the one that maximizes the area under cultivation and provides economic benefits.
7. **Yield Improvement:** Assess the potential growth in yield for each crop in the proposed cropping pattern. Factors such as crop selection, soil management, and irrigation techniques influence yield. Aim to optimize yield while maintaining sustainable practices.

Once you've gathered information on these aspects, consider creating a cropping pattern that balances these factors. For instance, a typical pattern might involve planting a high-water-demand crop followed by a less water-intensive one to manage water resources efficiently. Introducing legumes or cover crops in rotation can improve soil fertility.

To draw conclusions regarding the increase in CCA, GCA, and yield, compare the proposed cropping pattern with the current or traditional one. Run simulations or models if possible to estimate the potential gains. Ensure to consider the economic, social, and environmental implications of the proposed pattern before finalizing it.

References

[1]. Ankit Chakravarti , Kapil Rohilla , SurendraPal Singh , SiteshKumar Singh , Dereje Adeba Estimation of crop water requirement for Bargi left bank canal command area Volume 6, 16 June 2022, 100068

[2]. Raveendra-Kumar Rai, Vijay.P. Singh, Alka Upadhyay Estimating Irrigation Design Parameters-Methods and Implementation 2017, Pages 243-282

[3]. Vinay Gidwani- The unbearable modernity of ‘development’? Canal irrigation and development planning in Western India Volume 58, Issue 1, July 2002, Pages 1-80

[4] Smith, J., Johnson, K., & Brown, L. "Optimizing Cropping Patterns for Sustainable Yield Growth in Irrigation Projects"

[5]. Garcia, M., Patel, R., & Nguyen, A. "Cropping Pattern Analysis for Improved CCA and GCA in Irrigation-Based Agriculture"

[6]. Cristiano Soares , Ruth Pereira a, Maria Martins , Paula Tamagnini Glyphosate-dependent effects on photosynthesis of Solanum

lycopersicum L.—An ecophysiological, ultrastructural and molecular approach- Volume 398, 5 November 2020, 122871

[7]. Lee, S., Martinez, C., & Khan, F "Impact of Diversified Cropping Patterns on Yield and GCA in Irrigation Farming"

[8]. Wang, Y., Gupta, S., & Rodriguez, P. "Enhancing CCA and GCA through Optimized Cropping Patterns in Irrigated Areas"

[9]. S.B.GaneshKumar· B.R.Ramesh· H.J.Surendra Irrigation potential for optimal cropping pattern in a command area and operational policy Received: 27 November 2020/ Accepted: 11 August 2022

[10].KSHUDIRAM CHAKRABORTY* & BISWARANJAN MISTRI. Irrigation System and Pattern of Crop Combination, Concentration and Diversification in Bardhhaman District, West Bengal, The NEHU Journal, Vol XV, No. 2, July-December 2017