

A Geographical Analysis of Water logging in Haryana

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ABSTRACT

An area is said to be waterlogged when the depth to water table is within 0- 3 meters from the grounds surface. Under this situation, the groundwater moves upward and the pores of soils remain saturated with water. Upward moving water also brings salt to the land surface resulting in the process of salinization. Accompanied with an incidence of waterlogging in the state is the problem of accumulation of soluble salts in the soil profile. Soil becomes saline as a result of the concentration of salts in the upper layer, ground water moving upward brings salt contents when after evaporation get accumulated at surface. In Haryana more severely affected district are Karnal, Kurukhstra, Jind, Hissar, sonipat, Jhajjar, Rohtak district. The aim of the study is to investigate and evaluate waterlogging problem in these districts.

The data have been taken from Agriculture Department, Rohtak, Journals and research papers etc. Reduction in agricultural production, agriculture income hence reduces the economic conditions of farmer as well as standard of living and livelihood of farmers.

Water logging is a critical problem for agriculture and overall development of the region. It is find out that waterlogging influence the cropping pattern in agriculture sector. So due to this point of view, it is necessary to understand the waterlogging problem and its impact on the changing pattern of crops.

Keywords: Water logging, Salinity, Topography, Victims.

INTRODUCTION

In general usage, the incidence of waterlogging relates to a situation when the land surface gets inundated with water in the absence of proper drainage outlet. However, in agriculture science, the term water logging defined differently. An area is said to be waterlogged when the depth to water table is within 0- 3 meters from the grounds surface. Under this situation, the groundwater moves upward and the pores of soils remain saturated with water. Upward moving water also brings salt to the land surface resulting in the process of salinisation. Therefore, the problem of waterlogging and salinisation almost occur simultaneously in an area.

According to Singh (1978), land is said to be waterlogged when the soil pores within the root zones of crop get saturated with water, cutting the normal circulation of the air, which is very necessary for the growth of plants and reduces yields of the crops.

The Ground Water Cell of Haryana classifies waterlogging into three categories:-

- a) Fully water logged area: Where depth to water table is between 0 -1 meter from the ground surface.
- b) Water logged area: Where depth to water table is between 1 to 2 meters.
- c) Potential water logged area: Where depth to water table is between 2 to 3 meters.

It may be noted that water logging of the first two categories are more harmful than the third category.

The development of irrigation network in arid and semi-arid areas in India resulted in the problems of waterlogging and salinity. Waterlogging is a problem associated with practically all the irrigation project in the country. However, in canal-irrigated areas with poor drainage facilities and brackish ground water, the problem has assumed serious

proportion in India. Waterlogging problem affects human occupancies of land in a variety of ways. The foremost victim is the agricultural practices, due to waterlogging more and more land becomes unfit and goes out of cultivation. The cropping pattern undergoes a drastic change in favour of water intensive crops. The spread of paddy cultivation in non-traditional areas in India is one such example of waterlogging which adversely affects the quality and content of soils.

According to Joshi (1987), in the initial stage, productivity level in the affected areas declines sharply. In the absence of any corrective measures the land ultimately turns into Wasteland and goes out of cultivation. The result affects one loss of natural resources, ecological imbalances, unemployment, regional disparity, and growing incidence of poverty and out migration. In the Waterlogged areas, excessive moisture in the soil inhibits the growth of plants. Further ground water starts moving upwards by capillary action and is lost through evaporation from the land surface resulting in accumulation of salts in the soil profile. This process of salt accumulation is known as salinisation.

Accompanied with an incidence of waterlogging in the state is the problem of accumulation of soluble salts in the soil profile. Soil becomes saline as a result of the concentration of salts in the upper layer, ground water moving upward brings salt contents when after evaporation get accumulated at surface. Salinity also results from excessive use of chemical fertilizers in the farming operations.

Rajan (1978), has defined lands as those lands, which have an excessive amount of soluble salts, or exchangeable sodium due to which crop production is seriously hindered. They are also referred to as salt affected soils. There are several local names of rich soil known as user land.

According to Chopra (1989), salinity can also occurs independent of water logging in part accentuated by overuse of chemical fertilizers and pesticides.

The areas where precipitation is usually less than evaporation, in association with element of topography leading to impeded drainage or with ground water hydrology characterised by high water table enriched in soluble salts, are more marked with the problem of salt accumulation. The prolonged use of saline irrigation water under such conditions also brings results in soil salinity. The effects of canal irrigation vary according to local condition of the soil, topography, climate and water use. It has been observed that though the quality of water is generally good, the canal irrigation leads to soil salinity in many parts of the country. The canal water gets salt content during its course and affects the irrigated land. This problem is mainly due to over irrigation, mismanagement of irrigation water, seepage from canals and rise in water table. The available information shows that many areas, which are fertile and productive before the introduction canal irrigation networks, are now affected by water logging and salinity (Rajan,1998).

The saline soils are found to be distributed throughout India. These are inter zonal soils, which are characterised by high salinity or sodiumization or both simultaneously. It has been estimated that an approximate area of about 7 million hectares is covered by such soils all over the country (Planning commission, 1992).

According to estimates in Haryana, an area an area of nearly 440000 hectares is having water table below 3 meters from surface. In Punjab 250,000 hectares, in Maharashtra 55,230 hectares and in Jammu and Kashmir 45,000 hectares are to be critical.

The problem of user is found in Haryana. In Haryana more severely affected district are Karnal, Kurukhstra, Jind, Hissar, sonipat, Jhajjar, Rohtak district.

Salinity also affects the cropping pattern. It is estimated that due to high level of salinity, the crop like Gram and Oilseed are negligible in these areas.

Besides areas under canal irrigation are getting waterlogged, as a result of which sub soil water level has steadily risen and large tract of land are going out of cultivation especially in the Indo- Gangatic plains characterized by flat land and poor outflow.

Aim and objective of the study:-

- (i) To investigate and evaluate the water logging problem in the area.
- (ii) To examine the problem of water logging and their impact on changing pattern of crops.

Methodology:

The present study is based on the data collected from different sources published in government report, bulletins, Newspapers, Ground water cell, Agriculture Department Rohtak.

Review of literature

Agoras et al. (1996), conducted a meso level study and suggest that severity of problem of water logging and salinity in the state of Haryana is causing the loss of Rs.860 million by the year 2000.

Cauppens et al. (1997), discussed that rainfall problem inherited due to climatic conditions (high temperature and low rainfall). The net movement of water is upwards. The salts dissolved in the water accumulate slowly and gradually in the surface of the soil as the water evaporates. Hence, soil salinity pattern changes with the variation in the frequency and intensity of rainfall as well as temperature regimes. Mostly, salts accumulate on the Surface in the winter and dry season and are washed down into the lower profile with and adversely affect the export import earnings.

Setter (1999), studied about stress on plants imposed by flooding of the soil and deeper submergence constitutes one of the major abiotic constraints on growth, species distribution and agricultural productivity. Waterlogging is estimated to reduce yields on average by 20 to 25%, but the loss may exceed 50% depending on the stage of plant development. 50 % loss in agricultural yield can be catastrophic in the future, especially for developing countries, which is why, research into waterlogging is crucial for agricultural sustainability and food security. The general effect of waterlogging on plants ranges from physiological, developmental and metabolic effects which are mentioned in a few publications. Waterlogging is a major problem restricting the plant growth by leading to oxygen deficiency around roots and rhizomes, and consequently it can be fatal because aerobic respiration ceases and levels of energy-rich acetylates drop rapidly resulting in dramatic decrease in ion uptake and transport.

Ramparsad Sengupta (2001), rightly observed that 1970 , world's farmers lost an estimated 480 billion tons of top soil, which roughly equivalent to India's crop land .Shortsighted economic policies due to high time preference has resulted in Soil erosion in North America. Acidification in soil in Europe , deforestationand desertification in Asia, Africa and Latin America. In the third world land degradation has been quite severe due to soil erosion, waterlogging,salinization, alkalinastion.

Visser et al. (2003), try to illustrate some of the impacts that waterlogging has on plants, in monocotyledons & dicotyledons. The review includes, a general introduction into the impact of anaerobic/waterlogged soil condition on plants, quoting from different sources in this field. Then it focuses on five plant species of global interest or importance, Barley, Tomatoes, Soy Bean, Cotton and Rice, showing the effect of water logging on each, quoting journals and experiments done by fellow scientist .The topic of research into waterlogging is vast, with thousands of journals and experiments on countless plant species, so I'm focusing on just five .Flooding and submergence are major abiotic stresses and rank alongside water shortage, salinity and extreme temperatures as major determinants of species distribution worldwide. Plants adapt to their ever-changing environment in many ways.

Sai Ram et al. (2009), conclude that the majority of plants respond negatively to waterlogging while some plants respond positively. Plants throughout the years have adapted different ways to minimize damage caused by waterlogging. All plants pose survival mechanisms which are of a complex nature, and differing between some species. Plants also differ in the way they respond to anaerobic or anoxia soil conditions, some are extremely tolerant, some very sensitive and some in between. Even species that are susceptible to poorly aerated conditions possess metabolic and molecular responses that lengthen survival time from a few hours to several days. All plant species synthesize so-called anaerobic proteins that enable an oxygen-independent energy-generating metabolism to proceed where fermentable substrates are available.

Prema Broker (2011), analyses impact of water logging on cropping pattern in her research paper the major food crops cultivated are Soybean, Rice, Jowar, Pigeon pea, Chickpea and Wheat, whereas, the major commercial crop cultivated in Chandrapur district is Cotton. Further, groundnut sunflower etc. is also cultivated in the region. Rice crop topped in the cropping pattern with 27 per cent area in 1998-99 and increased to 32 per cent in 2008-09. While soybean crop was second in the rank, it showed an increasing trend from 1998-99 (22.34 per cent) to 200809 (36.78 per cent) and topped in the cropping pattern. Jowar crop which ranked third in the cropping pattern with 18.36 per cent in 1998-99 decreased to 1.23 per cent in 2008-09. Cotton crop which ranked fourth in the cropping pattern with 10.39 per cent in 1998-99 decreased to

9.87 per cent in 2008-09. The gross cultivated land was 5071 hectares in 1998-99 and it decreased to 4946 hectares in 2008-09. To test whether there is a shift in the cropping pattern, Spearman's rank correlation coefficient method.

Ashraf (2012), concluded in his articles waterlogging is the major obstacle for sustainable agriculture. Plants subjected to waterlogging suffer from substantial yield losses. Plants often get exposed to transient or permanent waterlogging. Sauter (2019), concluded that rice is well adopted partial submergence rendering it a suitable crop plant to understand flooding tolerance.

Causes of water logging

Nearly a century ago, the water table in this region was very deep i.e. from 30 to 70 meters, under prevailing natural dry environment before the introduction of canal network. The quality of ground water at deeper depth was saline and hence was not useful for crops. To boost the agriculture production, canal network was introduced in the state of Haryana particularly during the post green revolution period and brief outline of the causes underlying waterlogging in the Northwestern part of India.

Physical Factors Affecting Water logging Problem:-

(i) Poor Drainage system-

The topography of the waterlogging area is marked by plain and undulating sandy and alluvial plains. In the southern part of northwestern India it slopes toward north due to topographical structure. The north generally slopes towards south, thus forming a bowl type basin in the central part of Haryana. Due to poor drainage system, water remains standing on the surface for a longer time. The outflow of water is obstructed by the construction of road and canal. These structure work as a barrier to natural flow of water. Overflow of water from outlets near the canal is also one of the causes of waterlogging in these areas.

(ii) Climate:

Arid and semi- arid types of climatic conditions characterise North-Western states of India. These states are normally deficient in rainfall over its greater part.

Due to deficient rainfall and scarcity of water irrigation become very necessary for agriculture economy of the region. The quality of ground water is not good in greater part. Much of the time as therefore been on canal irrigation in these arid and semi-arid areas has resulted the problem of waterlogging.

Irrigation project in arid region of Rajasthan Indira Gandhi canals have converted a large area in saline and waterlogged. On sharda Sahayak irrigation project, productivity in the saline and waterlogged area is reduced to nearly half than productivity of normal soil (Jha, 1997).

Man Made Factors Affecting Water logging Problem:-

(i) Seepage from canal-

Due to its climatic condition poor quality of ground water, the canal irrigation network was introduced for better agriculture production. The network of canals has contributed a lot in the rise of water table of the region most of the canal has been constructed above the ground level. So the waterlogging conditions are much near the canals then the places away from them.

(ii) Transport system-

The problem of water logging is further accentuated by the existence of man-made barriers like the network of roads and canals, which obstruct the natural flow of water.

Conclusion

All studies reveal that soil salinity is a measure cause of water that is excess water use and wrong agricultural practices such as mono-cropping, overdose of fertilizer, pesticides etc. Also salinisation due to inadequate facility of drainage of water. Ultimately, soil salinity adversely affects the land productivity. Reduction in agricultural production, agriculture

income hence reduces the economic conditions of farmer as well as standard of living and livelihood of farmers.

Water logging is a critical problem for agriculture and overall development of the region .It also influence the cropping pattern in agriculture sector. So due to this point of view, it is necessary to understand the waterlogging problem and its impact on the changing pattern of crops.

Water logging of agricultural lands occurs when there is inadequate oxygen available in the crops root zone as a result of excess water. Reduced oxygen supplies to a crops root as a result of a shallow water table reduces nutrient uptake, crop growth, and yield.

In general, when a shallow water tables exists the yields of most crops can be related to the depth of the water table. For most crops there exists a water table depth, at which aeration, moisture, and nutrients are such that crop yields can be maximized. When the water table rises above this threshold, crop yields begin to decline.

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