International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182, Print ISSN: 2349-5979, Impact Factor: RJIF 5.72
www.allsubjectjournal.com
Volume 3; Issue 5; May 2016; Page No. 341-344

Water logging and salinity: Issues and challenges in restoring the land resource

[1] Dr. Ved Parkash, [2] Dr. Chander Mohan

[1] Assistant Professor of Botany, Govt. College of Education, Bhiwani, Haryana, India
[2] Assistant Professor of Geography, Govt. College, Narnaul, Haryana, India

Abstract
One third of the agriculture lands are facing the problem of salinity and water logging. The water table has risen to variable depths in different regions of Haryana including Hisar, Sirsa, Rohtak, Jhajjar and some villages of district Charkhi Dadri. It has transformed a large component of land barren i.e. unfit for agriculture purpose.
Agricultural ecosystems are man management ecosystems for growing crops and fodder for the livestock. In some of the villages of the study area, mustard, bajra, rice and wheat are the major crops. But during last few years the practice of growing rice is increased several folds. The reasons are reciprocal i.e increased canal based irrigation and seepage of water from earthen canals has raised the water levels. It has inhibited the growth of traditional crops and favoured the cultivation of wheat and rice and other water loving weeds. Further due to more economic gain, the farmers adopted the practice of growing wheat and rice as choice and not as compulsion. These two crops need excessive irrigation. As a consequence, some low lying areas are severely suffered from water logging problem. Extensive irrigation in these villages has resulted in water logging and salinity of lands. In the survey, it is found that underlying strata below the A- horizon of soil in study area is having clay layer which prevented the natural drainage of surface waters. Further, there is sufficient recharge of underground water from canals and monsoon waters. In the present paper it tried to find out various approaches useful in managing water salinity and reclamation of water logged lands. It is also aimed at suggesting a suitable model for efficient water drainage. The agroforestry regions are found less affected by water logging and thus less salinity, so such type of practices can be adopted to tackle the problem of water logging and increasing salinity.

Keywords: bio-drainage, water logging, salinity, evapotranspiration, seepage

Introduction
Water logging is a condition where the soil upper strata become fully saturated with water and the plant roots get deprived of oxygen to breath. Water logging is not always due to rising of water table, it may be due to very poor drainage capacity of the rooted zone of the soil. Soil and water management are necessary for the sustainable agriculture ecosystem. There are many ways of managing water logging condition. One of the cost effective model is agroforestry, which appears to be an answer for both these issues. Agroforestry is a process of growing trees along with the crops either at bunds or by intercropping. It serve many purposes. On one hand it is aimed at obtaining crop production on short term basis and obtaining forest products on long term basis. Along with economic benefits, there are many ecological benefits associated with agroforestry.
There is a complementary association between the crops and trees. It create a suitable environment for the normal growth of soil micro flora and fauna while counteracting the greenhouse effect. It improve the physical, chemical and biological properties of soil. One of the important issue to be addressed is the mutualistic survival of forests and crops in reference to their use of water and nutrients present in the soil. Agroforestry can improve the soil quality by enriching the soil nutrients and preventing the leaching of nutrients in the underlying water table. Other issue to be addressed is the problem of water logging. The rural economy and agriculture in Haryana is under threat due to mismanagement of water and land resources. Excessive irrigation and faulty cropping patterns have created a large component of land barren and unfit for agriculture purpose. Due to excess irrigation and poor natural drainage of water, the low lying lands are becoming water logged.
Rice –wheat system of cultivation has resulted in over use of water. As a result the soil salinity and water logging are becoming big problems. As per working group (Natural Resource Management) report of Haryana Kissan Ayog (2013), out of 44021 lakh hectares of area in Haryana, more than 50,000 hectares is having water table less than 1.5 meter deep and the extent of salinity in water logged areas is 35-40 Deci Siemens per meter (ds/m) as compared to normal level of 2ds/m. Despite the impressive achievements in Agriculture, the cultivation area is decreasing, soil salinity is increasing, water table is decreasing or increasing at different places. In state Haryana, nearly 50% area faces rising ground water table and salinity problems and about 10% area (0.44 mha) has already become waterlogged (Expert Committee 1998). So, the total cultivated area is decreasing and the demands for crop products is increasing. The problem is very serious in arid and semi- arid regions where underground water is already of poor quality like in southern parts of Haryana. There is a huge pressure on canals to support Agriculture, livestock and domestic consumption including drinking water. Natural fresh water lakes are not found in the study area. Further, the ponds in the villages of study area are filled by water available from canals.
The Working Group of Ministry of Water Resources on "Water logging, Soil Salinity and Alkalinity (1991)" prescribed the norms for defining waterlogged, saline and alkaline areas. According to these norms, an area is said to be

water logged (due to rise in water table) if the water table lies within 2 meters of land surface. An area is said to be potentially water logged if water table is between 2 and 3 meters of land surface. The area is taken as safe if the water table is below 3 meters of land surface. There are several ill effects observed due to water logging. Some of these are as below

1. Water logging provide suitable place for growth of methanogens that produce methane and add to greenhouse effect.
2. Consistent low soil temperature
3. Crop yield is measurably lowered
4. Water logging create anaerobic conditions which may kill the beneficial aerobic bacteria of the soil.
5. High salt conc. and less aerated soil Inhibit seed germination and growth of plants.
6. Promote growth of water loving weeds which compete with the crops for nutrients.
7. A large part of Agriculture land is transformed into marshes.

Thus, there is an urgent need to deal with increasing water logging and salinity conditions in Haryana. Conventional methods of water drainage are not only costly but also cause eco- degradation and leaching of nutrients. Various methods of minimising water logging and salinity are

1. Bio-drainage method
2. Proper surface and subsurface drainage system
3. Crop Rotation

Biodrainage involve the growing trees in water logged lands. These plants are generally with larger leaves, deeper roots and fast growing habit. They are friendly with co-crops i.e. do not produce any allelopathic substance to inhibit growth of crops. The best example is Eucalyptus having very high rates of transpiration (about 1250 litre per day).Other species include Populus, Casuarina etc. The whole process of bio-drainage involve absorption of water, ascent by xylem and then transpiration of absorbed water. About 98 % of absorbed water is transpired and only 2.0% is retained by the plant itself for maintaining the turgidity. Bio-drainage model can be applied as control measure in water logged lands with water levels up to 3 meters and as preventive measure in lands having water table in the depth range of 3-9 meters to prevent water logging.

Advantages of Bio-drainage

a) It is a cost effective model
b) Trees absorb excess of Co2 from air thus nullifying the excess greenhouse effect.
c) Improve the soil fertility by improving the soil texture, micro flora and fauna.
d) The fallen leaves and twigs from trees undergo decomposition and thus enrich the soil with mineral nutrients and humus.
e) Prevent water lodging of crops due to heavy winds.
f) Provide suitable home for birds and insects many of which are friendly and help in pollination and dispersal of seeds/fruits.

Surface drainage and subsurface drainage are the conventional methods of water drainage. Surface drainage involves draining excess water from the surface into the low lying furrows through slants. Some open channels are made which collect the surface water into canals or the ponds. Sub surface drainage systems involves layering of tiles or buried drainage pipes. But these are costly methods and also require high level of technical skills.

Crop rotation is another approach to minimise the problem of water logging. Crops requiring less water can be grown intermittently instead of growing wheat and rice repeatedly.

Aims of the study

Soil and water management are necessary for sustainable agriculture. A large segment of valuable productive land is becoming barren due to water logging and salinity. The reclamation of such lands is possible only if we understood the reasons and then develop suitable feasible, cost effective model. The broad aims of the present paper are

1. To find out the reasons for water logging and salinity.
2. To know the impact of agroforestry on the water table.
3. To understand the water management practices adopted at regional level to reclaim the water logged and saline lands.
4. To suggest the possible best model for reclamation of salinity.

Methodology

The present research paper is based on the survey performed in the agriculture fields of villages of district Charkhi Dadri. Extensive survey was performed in villages of the study area, which are severely affected by water logging and salinity. During field survey, questions were asked from farmers regarding effects of water logging on the crop productivity, impact of planting trees on the water logging and in managing water resource. The questions also asked to know the impacts of water logging on socio-economic conditions of farmers during the last 2-3 decades. Elderly farmers were selected as study subjects to understand whether the changes in crop patterns are the result or the cause of water logging. Soil samples and soil texture was observed and was compared with normal unlogged soils.

Importance of study

The economy of farmers and of the country is based on agriculture. For the sustainable agriculture the water and soil resource should be managed properly. During last few years the cropping pattern is diverted from traditional cropping to wheat- rice cultivation. This along with some other causes has generated the problem of water logging and soil salinity. As a result of salinity and water logging the yields are adversely affected. This has also resulted in other socioeconomic impacts. The present study deals with identifying the reasons, impacts and remedies of these two major problems. The findings of the present survey will definitely help the farmers to adopt a suitable model in a cost effective, affordable and scientific manner to deal with these two evils which are damaging the valuable water and soil resource.

Study area

Charkhi Dadri is located in southern haryanaat 28.600 Latitude and 76.267 Longitude. It is declared as 22th district of state Haryana. Is about 110 kilometer from national capital N. Delhi. According to the 2001 census the population of charkha Dadri was 44,892.The present study is restricted to some water logged lands of district Charkhi Dadri. This include agriculture lands of villages Jaishree, Misri and Kamod. These villages are located on the northern side of city.

The water table in these villages is about 10-20 feet which is raised to just 2-3 feet in rainy seasons and water start oozing out causing water logging situations.

The study area also possess some tracts of tiny forests commonly called "Bani". The banis are maintained on social forestry lands under the control of gram panchayats. Among all the natural resources, water is one of the most important resource for mankind, plant life and animal life too. "Not only it is a commodity which is directly used by man, but it is often the main-spring for extensive economic development, commonly an essential element in Man's aesthetic experience, and always a major formative factor of the physical and biological environment which provides the stage for this activities." The main source of water supply in Charkhi Dadri District are Canals, ponds and tube wells etc. District Charkhi Dadri has no River system.

It is estimated that about 50 percent villages of the district are having ponds in their close vicinity. Water is accumulated in these ponds in the rainy season. This water serves the secondary domestic purposes and for drinking water to the animals. In summer most of the Ponds get dry. The surface water is utilized for irrigation in the District through canals. As water is an essential ingredient of agriculture, without which seeds, soil and fertilizers can do nothing. Adequate availability of water makes it possible to have double or multiple crop, thereby raising the gross area under cultivation.

In the study area, the soil is poorly fertile. The terrain of the sandy tracts of the state has sandy soils. Charkhi Dsadri District is located in the sandy tracts. The colour of the soil is light grey. It is brought by the high speed warm wind of Rajasthan. It is not fertile. The soil of the Charkhi Dadri & Bhiwani Tehsil is sandy and domut.

During last 20 years due to excessive irrigation, the lands are suffering from logging problem. There is very poor percolation due to underlying clay strata in these villages of study area. Excessive evaporation during summers evaporate the water causing surface accumulation of salts. The saline and water saturated soil in many villages of the study area has converted the fertile tracts into barren lands.

Results and Discussions

In the present survey, it is found that the water logging is a major problem in the study area. Due to continuous rice-wheat cultivation the percolation of water through soil capillaries is increasing. The study revealed that during last 10 years, the number of tube wells are not increased and the cost of installing is decreased tremendously. This is all due to rising of water table. The amount of water recharge through rice-wheat cultivation is more than water drift through tube wells. This excess water is made available to the soils through canals. As a result there is continuous accumulation of underground water year after year.

Bio drainage model is economically viable because it requires only an initial investment of afforestation and when established, could generate economic returns by means of fodder, fuel wood and timber. Eucalyptus have shown promising results for reclamation of waterlogged soils through bio-drainage. It resulted in production of biomass without any extra cost and added to the farmer's economy.

In India, bio-drainage is still in experimental stage. Guidelines and suitable model is still not available. Studies to find out bio drainage potential of different plant species under various agro-climatic conditions, geometric approach of effective plantations, proper spacing, and botanical aspects relating to crop and tree interactions are to be conducted.

Some farmers reported the adverse effects of trees specially the *Acacia nilotica*. They prevented the germination of seeds of conventional crops. The same is not observed with Eucalyptus. A large number of factors are responsible for water logging. These include seepage from unlined earthen canals system, inadequate provision of surface water drainage, poor water management practices, and use of poor quality (highly saline in study area) groundwater for irrigation.

Though, availability of water is essential for better productivity, excess water in agricultural field is a serious challange to agricultural productivity. It impose negative ecological impacts like green- house gas (methane) emission from waterlogged areas and marshy lands of rice fields.

Conclusion and Suggestions

The water table can be lowered considerably by decreasing the rice cultivation area, promotion of low water demanding crops like guar, brassica and pulses. Further, agroforestry (bio-drainage) approach can minimise the water logging problem. It is a cost effective approach and involve community participation i.e. at individual farmer level. There is a need to practise irrigation practices with minimum flooding the surface. Proper levelling of the surface can also help in preventing the collecting of water in some regions. Soil texture can be improved by amending the soil with manures and gypsum. Water logging is directly related to salinity. Evaporation of water in summers can result in accumulation of salts on the surface and root zone. Thus multiple approaches are needed to tackle the problem.

Other stringent measures may be adopted at government level. This involves subsidising low water demanding crops, providing suitable and approachable market place to market the product of such crops.

The underground water from the "basin". It need to be managed properly from region to region and from time to time accordingly. There is a need to develop better varieties of trees like *Eucalyptus* and *Causaurina* with better evapotranspiration potential and suitable with economic crops and local climatic adaptability. But area to be covered under agroforestry vary from region to region depending upon the extent of rainfall, types of soils, salinity levels of underground waters etc.

References

1. Datta KK *et al*. Adverse effect of waterlogging and soil salinity on crop and land productivity in northwest region of Haryana, India. Agricultural Water Management, 57(3):223-238.
2. Bhumbla DR. Salinity and Alkalinity problems of arid regions of india, by CSSRI Karnal. 1978, 331-343
3. Ahmed P. Eucalyptus in agroforestry: its effects on agricultural production and economics. Agrofor. Syst. 1989; 8:31-38.
4. Kapoor AS. Biodrainage – A Biological Option for Controlling Waterlogging and Salinity, Tata McGraw Hill, New Delhi, 2001, 315.
5. NCID. Biodrainage status in india and other countries. Indian National Committee on Irrigation and Drainage (NCID), N. Delhi, 2003, 40

6. Khatkar RK, Luhach VP, Singh VK, Singh SP. Economic analysis of crops in Haryana. Department of Agriculture Economics, CCS, Haryana Agricultural University, Hisar, Bull. No. 63, 2008.
7. Singh A. Decision support for on farm water management and long term agricultural sustainability in a semi–arid region of India. Journal of Hydrology. 2010; 391:63-76.
8. Ram J. Biodrainage to combat waterlogging, increase farm productivity and sequester carbon in canal command areas of northwest India. Current science, 2011; 100(11)10.
9. Toky OP. Biodrainage for preventing water logging and concomitant wood yields in arid agro-ecosystems in north-western India. JSIR. 2011; 70(08):639-644.
10. Singh A, Panda SN. Effect of saline irrigation water on mustard (Brassica Juncea) crop yield and soil salinity in a semi-arid area of North India. Experimental Agriculture. 2012; 48:99-110.
11. Kumar Suresh, Chand Ramesh. Land use dynamics and erokping pattern case study of village in Karnal district of Haryana, 2012.
12. Minhas PS. Use ot tree plantation for water logging and salinity control: an overview and research needs. J water manage. 2012; 13:169-179.
13. Gulab. Impact of water logging and salinity on agriculture and socioeconomic status in Rohtak and Jhajjar. International journal for research in applied scienceand engineering technology. 2014; 2(IV):491-497.
14. Munesh Kumar. Salinity and changing pattern of Land Use Land Cover in Haryana: A case study of Rohtak district.Grip- the Standard Research, 2014; XXIV:15-24.
15. Arora KR. Irrigation Water Power and Wafer Resources Engineering,Standard publication, New Delhi.