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RESEARCH ARTICLE

IMPACT OF WATER BODIES ON YIELD OF COTTON CROP

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ABSTRACT

The second largest producer of cotton in the world after china is India, accounting for about 18% of the world's cotton production. In the world 12.2 million hectares area is under cotton cultivation. Per hectare yield is low. From 2002-2012 the range of yield of cotton kilogram per hectare was 350-500. The yield of cotton in India is low due to traditional methods used in the cultivation of cotton. Textile sector is the second largest provider of employment after agriculture (Maheshkumar, 2013). Most of micronutrients are present in the water when we supply the water after sowing the seeds, water soluble micronutrient increase the cell wall strength and preventing it from wilting (Zhang F.S., et al. 1991); pH of water is 7.0-7.5 which maintained the pH of soil and increases the yield of cotton crop from 740 kg/acre to 1260 kg/acre; the hardness of river water is 600-624 ppm due to the presence of chlorides, sulphate, carbonates, nitrates and phosphates of calcium, magnesium and other metal ions which play vital role in the yield of cotton crop. Zinc is an essential component of various enzyme systems for energy production, protein synthesis and growth regulation. A primary function of boron is related to cell wall formation, Sugar transport in plants, flower retention, pollen formation and germination. Seed as well as grain production are reduced with low boron supply. Iron is involved in the production of chlorophyll and iron chlorosis is easily recognized on iron sensitive crops growing on calcareous soils. Iron is also a component of many enzymes associated with energy transfer, nitrogen reduction, fixation and lignin formation. Iron is associated with sulfur in plants to form compounds that catalyze other reactions.

INTRODUCTION

Hardness of river water is due to the presence of sulphate, phosphate, carbonate, nitrate, bicarbonate, chlorides of calcium, magnesium and other metal ions. With increase in concentrations of sulphate (SO_4^{2-}), phosphate (PO_4^{2-}), carbonate ($CaCO_3^{2-}$), bicarbonates ($CaHCO^{3-}$), chlorides of calcium, magnesium and other metal ions in water the hardness of water increases exponentially. The sulphate of iron, Magnase, Calcium, Magnesium ($FeSO_4$, $MnSO_4$, $CaSO_4$, $MgSO_4$) play dual role in the growth of cotton crop. The pH of water plays a vital role in maintaining the pH of soil and its fertility (Hassan Azaizeh and Ernst Steudle 1991). Rain water is weakly acidic due to the presence of carbonic acid. Rain water having pH 5 to 6 means slightly acidic in nature, it alter the pH of soil but for the better growth of cotton plant pH of soil should be in the range of 7.05 to 7.50. Total Dissolved Solid (TDS) is due to presence of anions, cations, dust and humus matter, conductivity of water due to presence cations, anions such as K^+, Na^+, Ca^{2+}, Mg^{2+}, Fe^{2+}, Cl^-, F^-, SO_4^{2-},PO_4^{2-}, CO_3^{2-}, NO_3^{2-} etc. Dissolved oxygen increase the porosity of soil which helps or increases the rate of exchange of ions by the plant from soil and affect on the yield of the crop. Temperature is interrelated with the other parameters of water. By supplying river water after sowing cotton, water parameters play vital role in the development of crop.

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METHODS AND MATERIALS

Investigation of river water parameter

Investigation of pH: The pH of water is investigated with the help of Digital pH meter after calibration of instrument at room temperature.

Investigation of TDS: The TDS of water bodies investigated with the help of Digital TDS meter at 35 ^{0}c.

Investigation of conductivity: The conductivity of water bodies are investigated with the help of Digital conductivity meter after calibration of instrument using 0.01 molar KCl solutions.

Investigation of Hardness: The hardness of water sample is investigated by using EDTA complexometric titration method.

Investigation of Dissolved oxygen: The oxygen of water sample is investigated by using chemical method. Important parameters of water bodies are given in the Table 1.

Analysis of soil: We collected one kilogram soil sample from four different corners of the field and middle place of the field with the help of wooden stick and mixed the entire soil sample, from these five kilogram soil sample. One kilogram sample was taken and carried out for the analysis of soil. Testing Characteristics of the soil are given in the Table 2.

Table 1. indicate chemical parameter of rain water sample

Sr. No	Date and month	PH	Conductivity in Ms/cm	TDS	BOD	Total Hardness	Temporary Hardness	Permanent Hardness
1	1/6/2012	7.32	1.0	125	26ppm	350 ppm	30 ppm	320 ppm
2	2/7/2012	7.30	0.9	122	24ppm	345 ppm	29 ppm	316 ppm
3	1/8/2012	7.33	1.01	129	27ppm	352 ppm	31 ppm	321 ppm
4	5/09/2012	7.35	1.1	135	28ppm	356 ppm	32 ppm	324 ppm
5	5/10/2012	7.25	0.9	120	23ppm	340 ppm	27 ppm	313 ppm
6	5/11/2012	7.31	1.0	124	25ppm	348 ppm	31 ppm	317 ppm
7	6/12/2012	7.30	1.0	125	24ppm	347 ppm	30 ppm	317 ppm
8	9/01/2013	7.22	0.8	120	22ppm	340 ppm	25 ppm	315 ppm

Table 2. Show characteristic property of soil

Sr. No.	Characteristics of soil	Normal Quantity	Observations	Justification
1	PH of soil	7.1 to 7.5	7.66	Medium alkali
2	Nitrogen kg/hectare	281 to 420	286.72	medium
3	Single super phosphate kg/hectare	15 to 21	43.07	More
4	$KmnO_4$ kg/hectare	181 to 240	1130.44	more
5	Free CaCO3%	1 to 5	8.12	more
6	Zinc ppm	0.5 to 0.75	0.85	more
7	Cupper ppm	1 to 1.5	2.5	more
8	Iron (Fe) ppm	5 to 7.5	24.96	more
9	Boron ppm	0.03 to 0.06	0.9	more
10	Calcium (mg/100 gm. soil %)	65 to80	63.6	medium
11	Magnesium (mg/100 gm. soil %)	10 to 15	10.88	Very less

Table 3.

Sr. no	Nature of Treatment	Date of treatment		Remark/ Observation
		Treated cotton by River water	Treated cotton by rain water	
1	Date of sowing	7/6/2012	8/6/2012	Just one day difference
2	Water supply	7/6/2012 River water supply	8/6/2012 water supply through raining	Water soluble micronutrient directly absorbed by roots of plant in case of river water
3	Variety of cotton	Brahma (B.T)	Brahma (B.T)	Same variety
4	First dose of fertilizer	20/6/2012 D.A.P (S,N,P) 50 kg/acre	20/6/2012 D.A.P (S,N,P) 50 kg/acre	Supplement of 1st dose of fertilizer same quantity and quality /acre
5	Pesticide 1st dose	25/6/2012 Monocyte (500ml/acre)	25/6/2012 Monocyte (500ml/acre)	It control the attach of paste
6	Pesticide 2nd dose	5/7/2012 Astop+Factus (500ml/acre)	5/7/2012 Astop+Factus (500ml/acre)	Stop the attach of mouth, paste
7	Second dose of fertilizer	10/7/2012 20:20:0 50 kg/acre	10/7/2012 20:20:0 50 kg/acre	Growth of treated crops is more compared to Untreated
8	Pesticide 3rd dose	15/7/2012 Lupar+Abacyne (500ml/acre)	15/7/2012Lupar+Abacyne (500ml/acre)	Control the development of weed
9	Pesticide 4th dose	25/7/2012 Mono astop+Natio (500ml/acre)	25/7/2012 Mono astop+Natio (500ml/acre)	
10	Third dose of fertilizer	10/8/2012 Urea 50 kg/acre	10/8/2012 Urea 50 kg/acre	Growth of roots are fast as compared to untreated crops
11	Pesticide 5th dose	15/8/2012 Polo (Vin chin Vin) (500ml/acre)	15/8/2012 Polo (Vin chin Vin) (500ml/acre)	Increase the flowering of crop
12	Pesticide 6th dose	25/8/2012 Monocyte+Astop (500ml/acre)	25/8/2012 Monocyte+Astop (500ml/acre)	
13	Pesticide 7th dose	26/8/2012 (Mg+B+S) (1kg/acre)	26/8/2012 (Mg+B+S) (1kg/acre)	Essential micronutrients
14	1st pickup	320 kg per 2 acre	280 kg per 2 acre	First yield of crop
15	2nd pickup	2200 kg per 2 acre	1200 kg per 2 acre	Second yield of crop
16	Total yield	2520 kg per 2 acre	1480 kg per 2 acre	Yield difference=1040kg

Physical Characteristics of soil: It is thick, black, sand and gravels types of soil. The soil contains white crystal of calcium therefore the moisture holding capacity of the soil is less. Black soil indicates good fertility and we can use such soil for agricultural purposes such as cultivation of different crops.

For growth promoting effects: The two different beds of black cotton soil, 1.5 x 1.5 meter size were prepared in the two acre plots for seeds of Cotton specie. The plants of this Cotton species for examination were sowed in these beds separately by conventional method. One seed bed was irrigated by river

water initially, whereas another bed of seed with same variety under rain water treatment. The plants from each bed were divided in to two groups (X) and (Y). After germination of seeds, common treatment is applied to both groups, (X) plants were called as control group, whereas the plants from group (Y) designated as treated group plants. All the field experiments were conducted to compare the treated plant and control plant. 50 kilogram/acre DAP first dose of fertilizer was supplied, 50 kilogram/acre 20:20:0 second dose of fertilizer was supplied, 50 kilogram/acre Urea third dose of fertilizer was supplied, after 14, 20, 21 days respectively to both group of plants. 500ml/liter Monocyte first dose of pesticide supplied, 500ml/liter blend of (Astop+Factus) second dose of pesticide supplied, 500ml/liter blend of (Lupar+Abacine) third dose of pesticide supplied, 500ml/liter blend of (Mono astop+Natio) fourth dose of pesticide supplied, 500ml/liter Vin chin Vin fifth dose of pesticide supplied, 500ml/liter blend of (Monocyte+Astop) sixth dose of pesticide supplied, 1kg/acre (Mg+B+S) seventh dose of pesticide supplied after 18, 11, 10, 10, 20, 10, 1 days respectively to both group of plants. After collecting cotton from control and treated group (Fig 1and 2), there is difference in the yield of cotton crop and quality. When all the treated group plants were compared among themselves, it was distinctly observed that, the treated cotton plant showed the pronounced vegetative growth, yield than untreated cotton plant (Fig 1and 2). There has been fair amount of satisfaction in carrying out the present study. It is shown in the Table 3.

RESULT AND DISCUSSION

The total yield of treated group of cotton plot production is 1260 kg per acre whereas control plots 740 kg per acre due to hardness, pH, conductivity, TDS, DO of river water.

Table 4. Different parameters of River water

S. No.	Particulars	Unit	Analysis report
1	Colour	Hazen	Clear
2	Odour	-----	Odourfree
3	Turbidity	NTU	3
4	pH	Mmhos/cm	7.7
5	Electrical conductivity	mg/L	1068
6	Total dissolved solid	mg/L	764
7	Total hardness	mg/L	624
8	Calcium	mg/L	244
9	Magnesium	mg/L	32
10	Chloride	mg/L	246
11	Total alkalinity	mg/L	85
12	Corbonate	mg/L	10
13	Bicorbonate	mg/L	115
14	Nitrate	mg/L	16
15	Sulphate	mg/L	52
16	Iron	mg/L	0.4
17	Fluoride	mg/L	0.4
18	Sodium	mg/L	61
19	Potassium	mg/L	6
20	e-Coliform	MPN	Nil
21	Total coliform	MPN	Nil

The yield of cotton production increases with reference to hardness of water, hardness of water is due to presence of sulphate (SO_4^{2-}), phosphate (PO_4^{2-}), carbonate ($CaCO_3^{2-}$), bicarbonates ($CaHCO^{3-}$), chlorides of calcium, magnesium and other metal ions, it acts like essential micronutrient and push up the initial growth of roots, leaves, straw and colour of sibling, water soluble salts effectively percolate in the soil and reduces defiance of soil micronutrients and NPK of soil (Tim Knowles C., *et al.*, 1999). Salt maintained the pH of soil 7 to 8, due buffer action.

pH of soil: for the better yield of cotton crop pH play very important role in maintaining pH of soil.

Conductivity: conductivity of water increase the ions exchange capacity of sibling from soil. Total dissolved solid

(TDS), Dissolved oxygen (DO) depends upon the temperature of the water with increases in temperature TDS, DO increases the porosity of soil and rate of exchange of NPK, fertilizer by the plant from soil (Patrick, *et al.*, 1987).

Conclusion: it is influenced by the supplements of river water at the time of sowing due to presence of useful salt, trace micronutrients. It is also influenced by the pH, conductivity, Total dissolved solid, Hardness and dissolved oxygen of river water influenced the yield of cotton crop.

Fig. 1. shows Treated cotton crop

Fig. 2. shows control cotton crop

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