

Varietal sensitiveness investigation of cotton under sewage irrigation

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Abstract: A field experiment was carried out to investigate the relative performance of different varieties of cotton (MCU 5, MCU 7, MCU 11, ADT 1, SVPR 1, TCHB 213 and CCH 51) under sewage irrigation at Tamil Nadu Agricultural University, Coimbatore during 1999. It was observed that MCU 5 was relatively more tolerant with better performance among the set of seven varieties. It was noted that the hybrids TCHB 213 and CCH 51 showed early good vigour but in the flowering and maturation phases suffered from lack of flower formation, flower shedding, boll settings and number of bolls per plant. On the other hand MCU 5, which performed lower than hybrids during early stages showed greater tolerance during flowering and maturity phases exhibiting better yield attributes. The varietal sensitiveness investigations under sewage irrigations gave evidences for the overall reduced growth behaviour of even relatively more tolerant crop like cotton. From the studies it appears reasonable to focus MCU 5 as an ideal variety for sewage irrigation; this variety gave seed cotton yield of 1183 kg ha⁻¹ with fibre length value of 30.64 mm.

Key words: Sewage irrigation, Cotton, Screening varieties for sewage.

Introduction

In many parts of the world treated municipal waste has been successfully used for the irrigation of various crops including agronomic (Feigin *et al.* 1984), horticultural (Neilsen *et al.* 1991) and commercial crops especially cotton (Day *et al.* 1981). However, interest in the use of treated sewage effluent has accelerated significantly in the developing countries from about 1980 (Biswas, 1989). Application of 2/3 sewage in 3 irrigations appeared to be the best with regard to production of grain with satisfactory quality of wheat (Harigyan Singh (1965). In contrary, Rajarajan (1978) and Bahri (1987) reported raw sewage is as good as that of treated sewage effluent in their effect on soil and plant. However, studies carried out have shown that the use of treated sewage effluent and sludge with appropriate rate and nutrient management can increase profit by 20-30 per cent as compared to the normal cultivation practice. If all available sewage is collected and treated at least to primary level can enhance the irrigation potential by 1,70,000 ha in India besides preventing the

pollution of streams and lakes (Panicker, 1994). For the most beneficial recycling of sewage, it should be used according to the degree of treatment for different crop species (Juwarkar *et al.* 1992). These essentialities indicate that plant products which are directly consumed by humans should be grown with sewage effluent which has at least received secondary treatments.

Materials and Methods

A field experiment was carried out to investigate the relative performance of different varieties of cotton crop under sewage irrigation at Tamil Nadu Agricultural University, Coimbatore with seven prominent cotton varieties in randomized Block Design replicated thrice. The varieties tested were MCU 5, MCU 9, MCU 11, ADT 1, SVPR 1, TCHB 213 AND CCH 51 with the spacing for the hybrid 120 cm x 60 cm and non-hybrid 75 cm x 30 cm. The soil was clay loam in texture having pH and EC values of 7.40 and 0.32 dSm⁻¹ respectively. The available N, P and K contents were 408, 15.4 and 364 kg ha⁻¹ respectively with available

Table 1. Influence of sewage on germination and biometric data of cotton varieties

Hybrid/ Varieties	Germination (%)	Plant height (cm)			No. of monopodia per plant	No. of sympodia per plant	Dry matter production (kg ha ⁻¹)				
		Harvest					30	60	90	Harvest	
		30	60	90							
		DAS					DAS				
MCU 5	78.20	36.6	66.6	81.2	107.8	2.26	17.75	625	1210	2133	3766
MCU 9	56.16	30.2	52.2	73.2	92.2	1.90	16.36	540	1160	1924	3515
MCU 11	58.30	31.2	53.6	75.3	96.6	1.96	15.90	560	1184	1986	3673
ADT 1	52.25	26.6	47.2	70.2	90.3	1.84	16.05	500	1022	1866	3446
SVPR 1	54.30	32.2	54.8	72.1	91.8	1.92	16.95	508	1073	1896	3497
TCHB 213	70.26	36.2	69.7	89.3	112.6	3.36	20.44	660	1366	2292	4038
CCH 51	72.34	38.2	71.3	93.8	123.5	3.53	20.66	6647	1386	2328	4069
SED	2.05	1.53	2.59	2.34	4.68	0.130	0.528	19.33	10.36	22.22	16.82
CD (P=0.05)	4.47	3.34	5.64	5.10	10.20	0.283	1.15	42.12	22.57	48.42	36.65

Table 2. Influence of sewage on yield determinants of cotton varieties

Hybrid/ Variety	No. of fruiting points plant ⁻¹	No. of buds shed plant ⁻¹	No. of flowers plant ⁻¹	No. of flowers sheds plant ⁻¹	No. bolls shed plant ⁻¹	No. of bolls plant ⁻¹	Bud shedding (%)	Boll shedding (%)	Boll setting (%)
MCU 5	50.32	15.70	34.63	18.15	5.29	11.18	31.20	15.28	22.21
MCU 9	46.14	16.03	30.11	16.55	5.76	7.80	34.74	19.13	16.91
MCU 11	47.66	15.96	31.70	17.76	5.68	8.26	33.48	17.92	17.33
ADT 1	42.90	16.09	26.81	13.86	.89	7.06	37.51	21.97	16.46
SVPR 1	44.14	16.14	28.00	14.87	5.83	7.30	36.56	20.82	16.54
TCHB 213	85.40	26.84	58.56	30.85	9.05	18.66	31.43	15.46	21.85
CCH 51	87.39	27.28	60.11	31.69	9.20	19.22	31.22	15.30	21.99
SED	3.93	0.15	1.08	0.96	0.24	1.08	2.05	1.99	0.54
CD (P=0.05)	8.56	0.34	2.35	2.11	0.52	2.35	4.47	4.34	1.19

Table 3. Influence of sewage on yield and quality of cotton varieties (mean of three values)

Hybrid/ Variety	Boll weight (g)	Seed cotton yield (kg ha ⁻¹)	Seed yield (kg ha ⁻¹)	Lint yield (kg ha ⁻¹)	Seed index (g)	Lint index (g)	Ginning per cent	Fibre length (mm)	Seed oil content (%)
MCU 5	3.38	1183	764.4	418.6	6.26	3.43	35.40	30.64	20.86
MCU 9	3.16	748.8	485.0	263.8	6.16	3.35	35.23	30.38	20.70
MCU 11	3.21	811.3	525.6	285.7	6.20	3.37	35.21	30.48	20.82
ADT 1	3.03	637.0	414.3	222.7	6.14	3.30	34.96	30.28	20.65
SVPR 1	3.11	684.6	444.4	240.2	6.16	3.33	35.09	30.33	20.72
TCHB 213	4.36	870.8	557.5	313.3	6.51	3.66	35.98	30.96	20.90
CCH 51	4.66	977.0	624.7	352.3	6.60	3.72	36.06	31.16	20.96
SED	0.098	26.26	14.33	13.26	0.016	0.015	0.031	0.026	0.015
CD (P=0.05)	0.214	57.22	31.23	28.89	0.036	0.033	0.067	0.057	NS

micronutrients of 4.36, 2.12, 9.38, 6.55, 1.12 and 0.045 mg kg⁻¹ for Zn, Cu, Fe, Mn, P and Mo.

The crop was irrigated with sewage at 15 days interval totaling 13 irrigations and each time 5 cm depth of sewage was irrigated. The sewage flowing in the open channel was used for irrigation. During crop period there was 463 mm of rain spreading over 23 rainy days. The pH and EC of the sewage used for the experiment were 8.3 and 3.58 dSm⁻¹. The water quality parameters SAR, RSC, SSP and potential salinity values were 11.38, 2.96 me l⁻¹, 68.13 and 20.32 me l⁻¹ respectively and thus, it was saline sodic in nature. Besides the sewage also contained N, P and K contents of 56.2, 20.7 and 71.2 mg l⁻¹ respectively. The effluent also carried heavy metals to the levels of 2.10, 1.16, 1.60, 1.92 and 0.31 mg l⁻¹ of Pb, Cd, Cr, Ni and Co.

Results and Discussion

1. Germination and Plant biometric observation

The germination of the crop was found to be significantly influenced by the sewage irrigation. The highest per cent germination was associated with MCU 5 and the least germination value of 52 per cent with ADT1. Only three varieties namely MCU 5, CCH 51 and TCHB 213 recorded germination value exceeding 70 per cent. The plant height at 30, 60, 90, DAS and at harvest were found to be influenced by the varieties. At all stages of growth, hybrids CCH 51 and TCHB 213 were taller in relation to other non-hybrid varieties, and for instance CCH 51 recorded plant height of 36.3, 69.7, 89.3 and 113 cm at 30, 60, 90 DAS and at harvest. The variety MCU 5 recorded plant height on par with CCH 51 during early stages of crop growth. The number of monopodia and sympodial branches was also the highest in CCH 51 and TCHB 213 hybrids. Among others, MCU 5 showed 2.26 and 17.75 monopodial and sympodial branches respectively. The varietal sensitiveness investigation under sewage irrigation gave evidence for the overall reduced growth

behaviour of even relatively more tolerant crop like cotton. This corroborate with the findings of Ahmad *et al.* (1991), Ray and Khaddar (1991) and Munir Ahmad *et al.* (1995). This points out to the fact that appropriate management practices are warranted for increasing the yield potential of cotton under saline - sodic irrigation.

2. Dry matter production and Yield attributes

The dry matter production was again found to be related to the varieties variation. The hybrids recorded significantly high dry matter values of 4069 and 4038 kg ha⁻¹ at harvest for CCH 51 and TCBH 213 respectively as compared to 3446 to 3766 kg ha⁻¹ in others. Among the non-hybrids, MCU 5 rated the best with mean value of 3766 kg ha⁻¹. The yields attributed were also found to be influenced by the varieties. The hybrids recorded significantly higher number of fruiting points, flowers and bolls per plant. However, the number of bud shed, flower shed and boll shed were also highest under CCH 51 and TCBH 213 hybrids due to the saline-sodic nature of the sewage irrigation. Among the other varieties, the MCU 5 found to be the best with maximum number of fruiting points, flowers and bolls per plant with lowest percentage of bud, flower and boll shedding. But a significantly higher boll setting per cent was recorded by MCU 5 which was statistically on par with other hybrids.

3. Seed cotton yield

The seed cotton yield was found to differ significantly. Variety MCU 5 with mean yield of 1183 kg ha⁻¹ rated to be the best. The fact that it performed better even to the hybrids is worth mentioning. Perhaps it is a genetic factor and MCU 5 possessed greater tolerance at flowering and maturity phases to sewage irrigation. The hybrid CCH 51, TCBH 213 also recorded yields of the order 977 and 871 kg ha⁻¹ and may be considered next only to MCU 5. The varieties ADT 1 and SVPR - 1 were least efficient under the given situation with poor mean yield values of 637 and 685 kg ha⁻¹. It may be noted that while the hybrids

were associated with better growth vigor in terms of number of fruiting points, flowers and bolls production, they yielded much less compared to MCU 5 perhaps due to more sensitive nature due to saline-sodic sewage irrigation at flowering phase of the crop. The poor performance of crop in terms of dry matter and seed cotton yields under sewage irrigation was well revealed in the study. This may be the result of not only the saline - sodic nature of the sewage but also the direct and indirect influences related to crop nutrition that can be expected to follow such sewage irrigations. Similar views were also expressed by Ahmad *et al.* (1991) and Munir Ahmad *et al.* (1995). One among the vital limiting factors already identified was the positive RSC apart from the slightly enhanced EC values. The relative sensitiveness of cotton to RSC values had been well established.

3. Quality parameters

Higher ginning per cent, seed index, lint index and fiber length were recorded in CCH 51 which was statistically on par with TCBH 213. It may also observed that the variety MCU 5 recorded all the quality parameters on par with hybrids proving its tolerance under saline-sodic situation. Whereas, other varieties registered lower values due to influence of saline-sodic sewage irrigation.

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