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# RESEARCH ARTICLE

## INFLUENCE OF SEED FORTIFICATION TREATMENT WITH INDUSTRIAL EFFLUENTS IN PETUNIA

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**ABSTRACT**

Studies on evaluation of the influence seed fortification with industrial effluents in six different concentrations for 8 and 16 h soaking duration revealed that the effluents of TNPL, dye, tannery and sugarcane distillery at lower concentration of 5 per cent improved the seed and seedling quality characters. Among the effluent TNPL had more invigourative effect on seedling growth.

## INTRODUCTION

Urbanisation and industrialization increases the environmental pollution due to disposal of city waste, sewage water and industrial effluents. Research on reuse of sewage and industrial effluents in agriculture is gaining importance in this momentum as they are the important sources of nutrients and irrigation water (Zalawadia and Raman, 1994). Industrial effluent contains many plant nutrients though in lower concentrations there is a scope for using it for beneficial purpose provided, the other technological part is developed for its safer use. Screening of crops for their tolerance to different types of effluent is the need of this industrialised world. Based on the above views, the present investigation was carried out with petunia to trace their tolerance level to the various effluents on seed quality characters through seed fortification treatments.

## MATERIALS AND METHODS

The fresh seeds of petunia cv.Mix were soaked in equal volume of industrial effluents *viz*, Tamil Nadu News Print Paper Ltd (TNPL), dye, tannery and sugarcane distillery effluent diluted in different six concentration *viz.*, 5,10,20,30,40 and 50 per cent for 8 and 16 h. The seeds were shade dried for one day and evaluated for the seed and seedling quality parameters *viz.*, germination (%) (ISTA, 1999), root and shoot length (cm), drymatter production 20 seedlings (mg) and vigour index (Abdul Baki and Anderson, 1973). The data gathered were analysed statistically adopting the procedure described by Gomez and Gomez (1984).

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## RESULTS AND DISCUSSION

The present investigation on seed fortification treatment revealed that TNPL effluent recorded higher germination (83 per cent) followed by dye industry effluent (81 per cent) and least (69 per cent) was recorded by sugarcane distillery effluent irrespective of concentration and durations. Among the six different concentrations of the effluents, irrespective of types of effluent, seeds soaked in 5 per cent recorded the maximum (87 per cent) germination which was 15 per cent higher than the germination recorded by control seed and thereafter with increase in concentration, the germination per cent reduced rhythmically and it was the minimum at 50 per cent concentration with all the analysed effluent. Regarding duration, seed fortification for 8 h recorded higher germination (81 per cent) which was 9 per cent higher than 16 h soaking. Seed fortification with TNPL effluent at 5 per cent concentration recorded the highest germination of 90 per cent among the effluents. The increase in germination percentage at lower concentration indicated the invigourative action of the treatment on seed physiological function (Biradar *et al.*, 1989). It may be also due to the fertilizing effect at lower concentration under optimum conditions for germination (Jenath and Sahai, 1982) as reported by Behra and Misra (1982) with distillery effluent in rice, Somashekhar *et al.* (1984) with textile industry effluent in several field crops,

**Table 1 . Influence of fortification treatments with industrial effluents on seed and seedling quality characteristics at germination room**

| Effluents (E) | Concentrations in percentage (C) | Germination (%) | | | Root length (cm) | | | Shoot length (cm) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Duration in hours (D) | | | | | | | | |
| | | 8 | 16 | Mean | 8 | 16 | Mean | 8 | 16 | Mean |
| Dye | 5 | 96 (79.12) | 85 (67.02) | 90 (73.07) | 1.0 | 0.8 | 0.9 | 1.7 | 1.3 | 1.5 |
| | 10 | 92 (73.59) | 84 (66.45) | 88 (70.02) | 0.9 | 0.8 | 0.9 | 1.6 | 1.2 | 1.4 |
| | 20 | 88 (69.77) | 76 (60.67) | 82 (65.22) | 0.9 | 0.8 | 0.9 | 1.6 | 1.2 | 1.4 |
| | 30 | 80 (63.47) | 75 (60.00) | 78 (61.74) | 0.7 | 0.8 | 0.8 | 1.6 | 1.1 | 1.4 |
| | 40 | 80 (63.47) | 74 (59.34) | 77 (61.41) | 0.7 | 0.7 | 0.7 | 1.5 | 1.1 | 1.3 |
| | 50 | 76 (60.67) | 72 (58.06) | 74 (59.36) | 0.7 | 0.6 | 0.7 | 1.4 | 1.0 | 1.2 |
| | Mean | 85 (68.35) | 78 (61.92) | 81 (65.14) | 0.8 | 0.8 | 0.8 | 1.6 | 1.2 | 1.4 |
| TNPL | 5 | 96 (78.52) | 84 (66.48) | 90 (72.50) | 1.0 | 0.9 | 1.0 | 1.8 | 1.4 | 1.6 |
| | 10 | 88 (69.77) | 80 (63.51) | 84 (66.64) | 1.0 | 0.9 | 1.0 | 1.7 | 1.3 | 1.5 |
| | 20 | 88 (69.77) | 80 (63.47) | 84 (66.62) | 0.9 | 0.8 | 0.9 | 1.7 | 1.3 | 1.5 |
| | 30 | 88 (69.91) | 80 (63.45) | 84 (66.68) | 0.8 | 0.8 | 0.8 | 1.5 | 1.2 | 1.4 |
| | 40 | 84 (66.45) | 78 (62.06) | 84 (64.25) | 0.8 | 0.8 | 0.8 | 1.5 | 1.1 | 1.3 |
| | 50 | 80 (63.50) | 74 (59.34) | 77 (61.42) | 0.8 | 0.6 | 0.7 | 1.4 | 1.0 | 1.2 |
| | Mean | 87 (69.65) | 79 (63.05) | 83 (66.35) | 0.9 | 0.8 | 0.8 | 1.6 | 1.2 | 1.4 |
| Sugarcan e | 5 | 86 (68.10) | 80 (63.45) | 83 (65.78) | 0.9 | 0.8 | 0.9 | 1.5 | 1.2 | 1.4 |
| | 10 | 84 (66.43) | 72 (58.06) | 78 (62.24) | 0.8 | 0.8 | 0.8 | 1.4 | 1.0 | 1.2 |
| | 20 | 78 (62.06) | 68 (55.55) | 73 (58.81) | 0.8 | 0.7 | 0.8 | 1.3 | 1.0 | 1.2 |
| | 30 | 74 (59.36) | 64 (53.15) | 69 (56.26) | 0.7 | 0.7 | 0.7 | 1.3 | 0.9 | 1.1 |
| | 40 | 65 (53.73) | 56 (48.45) | 61 (51.09) | 0.6 | 0.5 | 0.6 | 1.2 | 0.8 | 1.0 |
| | 50 | 58 (49.61) | 42 (40.39) | 50 (45.00) | 0.6 | 0.3 | 0.5 | 1.2 | 0.7 | 1.0 |
| | Mean | 74 (59.88) | 64 (53.17) | 69 (56.53) | 0.7 | 0.6 | 0.7 | 1.3 | 0.9 | 1.1 |
| Tannery | 5 | 92 (73.59) | 80 (63.51) | 86 (68.55) | 0.9 | 0.7 | 0.8 | 1.6 | 1.3 | 1.5 |
| | 10 | 87 (68.87) | 76 (60.70) | 82 (64.78) | 0.8 | 0.7 | 0.8 | 1.5 | 1.1 | 1.3 |
| | 20 | 84 (66.48) | 72 (58.06) | 78 (62.27) | 0.8 | 0.7 | 0.8 | 1.5 | 1.1 | 1.3 |
| | 30 | 80 (63.47) | 68 (55.55) | 74 (59.51) | 0.7 | 0.6 | 0.7 | 1.5 | 1.0 | 1.3 |
| | 40 | 72 (58.06) | 60 (50.78) | 66 (54.42) | 0.6 | 0.6 | 0.6 | 1.4 | 0.9 | 1.2 |
| | 50 | 56 (48.45) | 48 (43.85) | 52 (46.15) | 0.5 | 0.4 | 0.5 | 1.3 | 0.8 | 1.1 |
| | Mean | 79 (63.15) | 67 (55.41) | 73 (59.28) | 0.7 | 0.6 | 0.7 | 1.5 | 1.0 | 1.3 |
| D x C | 5 | 93 (74.83) | 82 (65.11) | 87 (69.97) | 1.0 | 0.8 | 0.9 | 1.7 | 1.3 | 1.5 |
| | 10 | 88 (69.66) | 78 (62.18) | 83 (65.92) | 0.9 | 0.8 | 0.8 | 1.6 | 1.2 | 1.4 |
| | 20 | 85 (67.03) | 74 (59.44) | 79 (63.23) | 0.7 | 0.8 | 0.8 | 1.5 | 1.2 | 1.3 |
| | 30 | 81 (64.05) | 72 (58.04) | 76 (61.05) | 0.7 | 0.7 | 0.7 | 1.5 | 1.1 | 1.3 |
| | 40 | 75 (60.43) | 67 (55.16) | 71 (57.79) | 0.7 | 0.7 | 0.7 | 1.4 | 1.0 | 1.2 |
| | 50 | 68 (55.56) | 59 (50.41) | 63 (52.99) | 0.7 | 0.5 | 0.6 | 1.3 | 0.9 | 1.1 |
| | Mean | 81 (65.26) | 72 (58.39) | 77 (61.82) | 0.8 | 0.7 | 0.7 | 1.5 | 1.1 | 1.3 |

| CD (P=0.05 | E | D | C | ED | DC | EC | EDC |
|---|---|---|---|---|---|---|---|
| Germination | 0.907 | 0.641 | 1.111 | NS | 1.571 | 2.222 | 3.142 |
| Root length | 0.087 | 0.061 | 0.106 | NS | NS | NS | NS |
| Shoot length | 0.094 | 0.066 | 0.115 | NS | NS | NS | NS |

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| Effluent (E) | Concentration (C) | Drymatter production (mg 20 seedlings $^{-1}$) | | | Vigour index | | |
|---|---|---|---|---|---|---|---|
| | | Duration in hours (D) | | | | | |
| | | 8 | 16 | Mean | 8 | 16 | Mean |
| Dye | 5% | 2.0 | 1.9 | 2.0 | 260 | 178 | 218 |
| | 10% | 2.0 | 1.8 | 1.9 | 230 | 168 | 199 |
| | 20% | 1.9 | 1.8 | 1.9 | 220 | 152 | 186 |
| | 30% | 1.9 | 1.7 | 1.8 | 185 | 143 | 163 |
| | 40% | 1.7 | 1.6 | 1.7 | 177 | 134 | 155 |
| | 50% | 1.6 | 1.5 | 1.6 | 160 | 116 | 138 |
| | Mean | 1.9 | 1.7 | 1.8 | 205 | 149 | 177 |
| TNPL | 5% | 2.0 | 2.0 | 2.0 | 269 | 194 | 231 |
| | 10% | 2.0 | 1.9 | 2.0 | 238 | 177 | 208 |
| | 20% | 1.9 | 1.9 | 1.9 | 229 | 169 | 199 |
| | 30% | 1.8 | 1.7 | 1.8 | 202 | 161 | 182 |
| | 40% | 1.8 | 1.7 | 1.8 | 185 | 149 | 167 |
| | 50% | 1.7 | 1.6 | 1.7 | 177 | 119 | 148 |
| | Mean | 1.9 | 1.8 | 1.8 | 217 | 161 | 189 |
| Sugarcane | 5% | 1.9 | 1.8 | 1.9 | 207 | 161 | 184 |
| | 10% | 1.8 | 1.7 | 1.8 | 185 | 130 | 158 |
| | 20% | 1.8 | 1.7 | 1.8 | 164 | 116 | 140 |
| | 30% | 1.7 | 1.6 | 1.7 | 148 | 103 | 126 |
| | 40% | 1.6 | 1.5 | 1.6 | 117 | 73 | 95 |
| | 50% | 1.6 | 1.4 | 1.5 | 105 | 42 | 74 |
| | Mean | 1.7 | 1.6 | 1.7 | 154 | 104 | 129 |
| Tannery | 5% | 1.9 | 1.8 | 1.9 | 239 | 161 | 200 |
| | 10% | 1.8 | 1.7 | 1.8 | 200 | 138 | 169 |
| | 20% | 1.8 | 1.7 | 1.8 | 194 | 130 | 162 |
| | 30% | 1.7 | 1.6 | 1.6 | 177 | 110 | 143 |
| | 40% | 1.7 | 1.5 | 1.6 | 145 | 90 | 118 |
| | 50% | 1.6 | 1.5 | 1.6 | 101 | 59 | 80 |
| | Mean | 1.8 | 1.6 | 1.7 | 176 | 115 | 145 |
| D x C | 5% | 2.0 | 1.9 | 1.9 | 244 | 173 | 209 |
| | 10% | 1.9 | 1.8 | 1.8 | 213 | 153 | 183 |
| | 20% | 1.9 | 1.8 | 1.8 | 202 | 142 | 172 |
| | 30% | 1.8 | 1.6 | 1.7 | 178 | 129 | 154 |
| | 40% | 1.7 | 1.6 | 1.6 | 156 | 112 | 134 |
| | 50% | 1.6 | 1.5 | 1.6 | 136 | 84 | 110 |
| | Mean | 1.8 | 1.7 | 1.7 | 188 | 132 | 160 |
| CD (P=0.05) | E | D | C | ED | DC | EC | EDC |
| Drymatter production | 0.092 | 0.065 | 0.113 | NS | NS | NS | NS |
| Vigour index | 14.142 | 10.000 | 17.321 | NS | NS | NS | NS |

Gomathi and Oblisami (1992) with paper mill effluent in neem, pungam and tamarind, Aggarwal *et al.* (1994) with textile industry effluent in tree species, Selvakumar (1999) with tannery effluent in neem and Kumawat *et al.,* (2001) with dye industry effluent in ragi. The reduction in germination percentage recorded at higher concentrations irrespective of effluents might be due to the presence of excess amount of toxic metobolites in the effluents causing depletion of acids from tricarboxylic acid cycle which reduces the respiration rate and cumulatively reduced the germination (Kirkby, 1968). In other words it might also be due to the higher concentrations of solids in the effluents that had retarded the seed germination due to their toxic effect.

Adraino *et al.,* (1973) also opined that the higher solid and nutrients content of the effluent might be the limiting factor and it should be the cause for delay in germination . Ponmurugan and Jayaseelan (1999) revealed that the tannery and dye industry effluent had more amount of heavy metals like chromium and lead which were toxic to seeds. But in case of sugarcane distillery effluent due to the higher content of hydrogen sulphide, dissolved solids and higher BOD and COD level created the serious problem of respiration and reduced the germination when used at higher concentrations. The seedling growth characters like root length, shoot length, The growth parameters of the seedlings increased at lower concentrations of effluents due to invigourative effect, while at higher concentrations it decreased due to toxic effect. The seedling measurements were also higher with lower duration of soaking the 8 h.. Saxena *et al.* (1986) attributed that the decrease in vigour parameters *viz.*, root length, shoot length, drymatter production and vigour index at higher concentrations due to the lower amount of oxygen available to germinated seed which reduces their energy supply through aerobic respiration resulting in restricting the growth and development of the seedlings. Thus the study revealed that the effluents of TNPL, dfye tannery and sugarcane distillery at lower concentration of 5 per cent improved the seed and seedling quality characters. Among the effluent TNPL had more invigourative effect on seedling growth.

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