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Interaction effect of salicylic acid and paclobutrazol application on the growth characteristics of annual sports grass

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ABSTRACT

This study was performed to evaluation of salicylic acid and Paclobutrazol application on the growth characteristics of annual sports grass. The experiment was carried out as factorial in a completely randomized design that the first factor was salicylic acid levels (0, 100 and 200 ppm) and the second factor included paclobutrazol at four levels (0, 5, 15 and 30 mg per liter) with 3 replications. At the end of experiment some properties were determined such as RWC, Shoot fresh weight, Shoot dry weight, Root length, Membrane stability index. Totally, Means of all traits increased with increasing levels of salicylic acid from 100 to 200 ppm and highest means of RWC (92%), shoot fresh weight (9.7 grams per 5 cm), shoot dry weight (1.27 grams per 5 cm), root length (24.5 mm) and membrane stability index (84%) were obtained by treatment of 200 ppm. Also, paclobutrazol led to increasing of RWC but it led to reduction in other traits. Therefore, according to obtained results, application of 200 ppm salicylic acid and 30 ppm paclobutrazol recommended for sports grass planting.

Introduction

Salicylic acid (SA) is a natural phenolic compound present in many plant species at various levels. While the therapeutic benefits of SA and its acetylated derivative, aspirin, have been widely known for a long time, our insights into the role of SA in plants have emerged only during the past decade. A large body of evidence has shown that SA is a key endogenous signal involved in plant defense responses as well as flowering and thermogenesis (Dempsey et al., 1999; Raskin, 1992). Accumulation of SA is broadly accepted as a key signaling event in local and systemic acquired resistance against pathogens (Ryals et al., 1995; Draper, 1997; McDowell and Dangl, 2000). Much less is known about the downstream events of perception and signal transduction. Mateo et al (2006) Showed that high levels of SA are tightly linked to further metabolic alterations, affecting photosynthetic performance and redox homeostasis in plants. Growth retardation in plants with constitutively elevated levels of SA had been observed previously, but the cause remained unclear (Bowling et al., 1994; Mauch et al., 2001). Agarwal et al (2005) studied role of salicylic acid on antioxidant enzymes induction in wheat seedlings, Results revealed that SA induced H2O2 accumulation in germinating seedlings was not associated with inhibition of CAT or APOX. According to past studied, SA spray at 100 ppm resulted in significant increase in flower, height and seed yield when compared to other concentrations. Foliar spray of SA increased the number of flowers per plant and height in chrysanthemum (Padmapriya and Chezhiyan, 2002) and china aster (Ramesh, 1999). Paclobutrazol at 40 ppm recorded a higher dry weight compared to other higher concentrations of 60 and 80 ppm as well as control.

Increase in concentration of paclobutrazol spray reduced the number of flowers per plant also in china aster. However, the improvement in the number of flowers per plant due to paclobutrazol spray at optimum concentration, as compared to non-sprayed control was attributed to increased number of branches (Mishra and Mishra, 2006). The aim of this study was evaluation of Interaction effect of salicylic acid and Paclobutrazol application on the growth characteristics of annual sports grass.

Material and Methods

The experiment was carried out as factorial in a completely randomized design that the first factor was salicylic acid levels (0, 100 and 200 ppm) and the second factor included paclobutrazol at four levels (0, 5, 15 and 30 mg per liter) with 3 replications. At the end of experiment some properties were determined such as RWC, Shoot fresh weight, Shoot dry weight, Root length, Membrane stability index. RWC and Membrane stability index were determined according to Kirnak et al., (2001) and Sairam et al., (2005) methods, respectively. Shoot fresh weight and dry weight was obtained by digital Carriage scales.

Result and discussion

RWC

According to ANOVA, it was founded that salicylic acid, paclobutrazol and treatments interaction had significant effect on RWC at 5% statistically level (Table 1). Application of 100 and 200 ppm salicylic acid led to 4 and 6% increasing in RWC in compare to control, respectively. Also, 5, 10 and 15 mg/L paclobutrazol application led to 2, 4 and 4% increasing in RWC in compare to control, respectively. According to result of treatments interaction, it was determined that in present of 0, 100 and 200 ppm salicylic acid, application of 15mg/L paclobutrazol led to 4, 4 an 3% increasing in RWC in

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compare to 0 paclobutrazol (Figure 1). The effects of SA deficiency or constitutive SA accumulation on pathogen response and on cold or heat tolerance, flowering, and reproductive fitness have been reported recently (Clarke et al., 2004; Heidel et al,. 2004 ;Martinez et al., 2004; Scott et al., 2004; Larkindale et al., 2005).

Shoot fresh weight

According to ANOVA, it was founded that salicylic acid and paclobutrazol factors had significant effect on shoot fresh weight at 1 and 5% statistically level, respectively. Also it was determined that treatments interaction had significant effect on shoot fresh weight at 5% statistically level (Table 1). Application of 100 and 200 ppm salicylic acid led to 11 and 17% increasing in shoot fresh weight in compare to control, respectively. Also, 5, 10 and 15 mg/L paclobutrazol application led to 2, 6 and 12% decreasing in shoot fresh weight in compare to control, respectively. According to result of treatments interaction, it was determined that in present of 0, 100 and 200 ppm salicylic acid, application of 15mg/L paclobutrazol led to 4, 6 an 16% decreasing in shoot fresh weight in compare to 0 paclobutrazol (Figure 2). Among the different concentrations tried, SA at 150 ppm recorded the highest plant height when compared to lower concentrations. Padmapriya and Chezhiyan (2002) also registered a similar trend in plant height due to the spray of SA on chrysanthemum. SA was stated to have a direct involvement in plant growth by promoting ion uptake (Hayat et al., 2007). On the other hand, paclobutrazol significantly decreased plant height.

Shoot dry weight

According to ANOVA, it was founded that salicylic acid and paclobutrazol factors had significant effect on shoot dry weight at 1% statistically level, also it was determined that treatments interaction had significant effect on shoot dry weight at 5% statistically level (Table 1). Application of 100 and 200 ppm salicylic acid led to 14 and 33% increasing in shoot dry weight in compare to control, respectively. Also, 5, 10 and 15 mg/L paclobutrazol application led to 1.5, 6 and 11% decreasing in shoot dry weight in compare to control, respectively. According to result of treatments interaction, it was determined that in present of 0, 100 and 200 ppm salicylic acid, application of 15mg/L paclobutrazol led to 14, 15 an 15% decreasing in shoot dry weight in compare to 0 paclobutrazol (Figure 3).

Root length

According to ANOVA, it was founded that salicylic acid and paclobutrazol factors had significant effect on root length at 1% and 5% statistically level, respectively. Also it was determined that treatments interaction had significant effect on root length at 5% statistically level (Table 1). Application of 100 and 200 ppm salicylic acid led to 3 and 2% increasing in root length in compare to control, respectively. Also, 5, 10 and 15 mg/L paclobutrazol application led to 6, 15 and 29% decreasing in root length in compare to control, respectively. According to result of treatments interaction, it was determined that in present of 0, 100 and 200 ppm salicylic acid, application of 15mg/L paclobutrazol led to 30, 25 an 32% decreasing in root length in compare to 0 paclobutrazol (Figure 4).

Membrane stability index

According to ANOVA, it was founded that salicylic acid and paclobutrazol factors had significant effect on membrane stability index at 5% statistically level (Table 1). Application of 200 ppm salicylic acid led to 2% increasing in membrane stability index in compare to control, respectively. Also, 5, 10 and 15 mg/L paclobutrazol application led to 4, 6 and 9% increasing in membrane stability index in compare to control, respectively. Rao et al. (1997) have reported that salicylic acid induced hydrogen peroxide caused increased Cu/Zn-SOD activity and was independent of changes in catalase and ascorbate peroxidase activities. Pretreatment with salicylic acid also increased antioxidant enzymes activity and chilling tolerance in maize plants (Janda et al., 1999). Totally, Means of all traits increased with increasing levels of salicylic acid from 100 to 200 ppm and highest means of RWC (92%), shoot fresh weight (9.7 grams per 5 cm), shoot dry weight (1.27 grams per 5 cm), root length (24.5 mm) and membrane stability index (84%) were obtained by treatment of 200 ppm. therefore, according to obtained results, application of 200 ppm salicylic acid and 30 ppm paclobutrazol recommended for sports grass planting.

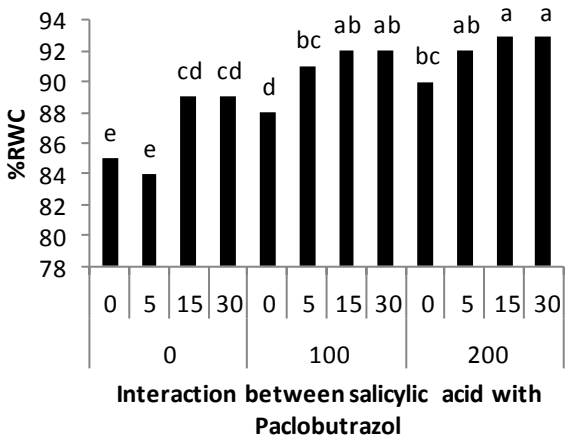

Figure 1. effect of treatments interaction on RWC (Duncan 5%).

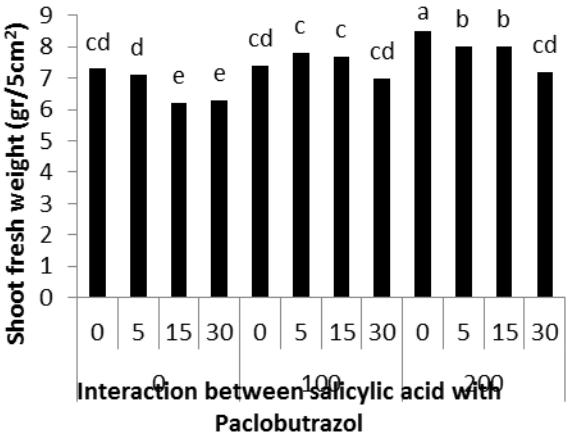

Figure 2. effect of treatments interaction on shoot fresh weight (Duncan 5%).

Table 1. Analysis of variances for studied traits in response to treatments.

	df	RWC	Shoot fresh weight	Shoot dry weight	Root length	Membrane stability index
salicylic acid	2	2390.96*	263.38**	264.71*	433.98**	104.30*
Paclobutrazol	3	1983.41*	168.93*	240.08*	284.73*	104.06*
Interaction	6	1575.86*	131.69*	240.08**	219.67*	49.90
Error	24	543.40	45.41	61.56	76.54	23.65
C.V%		15.30	7.50	8.30	5.90	11.20

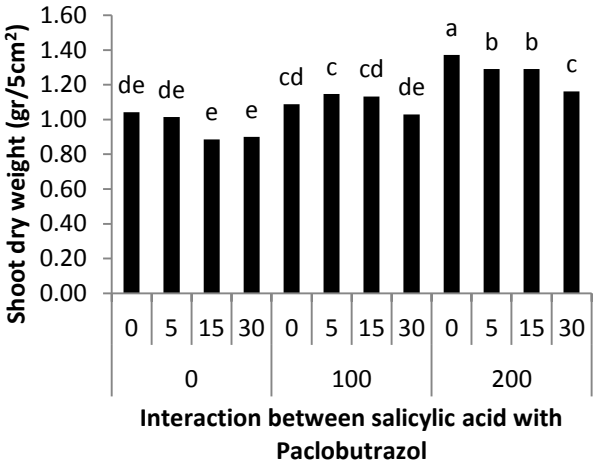

Figure 3. Effect of treatments interaction on shoot dry weight (Duncan 5%).

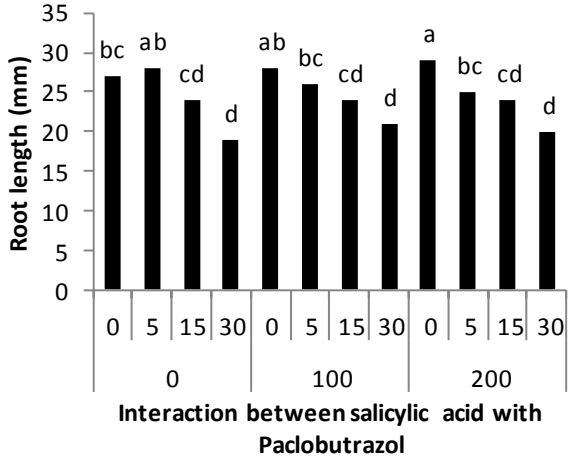

Figure 4. Effect of treatments interaction on root length (Duncan 5%).

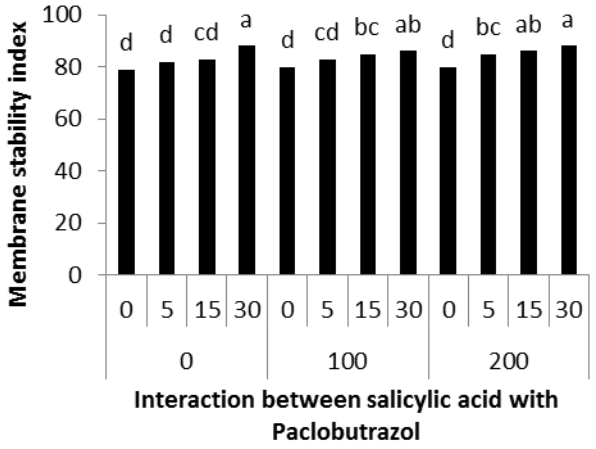

Figure 5. Effect of treatments interaction on membrane stability index (Duncan 5%).

References

1. Bowling SA, Guo A, Cao H, Gordon AS, Klessig DF, Dong X. 1994 .A mutation in Arabidopsis that leads to constitutive expression of systemic acquired resistance. The Plant Cell 6, 1845–857.
2. Clarke SM, Mur LA, Wood JE, Scott IM. 2004. Salicylic aciddependent signaling promotes basal thermotolerance but is not essential for acquired thermotolerance in Arabidopsis thaliana. The Plant Journal 38, 432–447.
3. Dempsey, D., Shah, J. and Klessig, D.F. (1999) Salicylic acid and disease resistance in plants. Crit. Rev. Plant Sci. 18, 547–575.
4. Draper J. 1997. Salicylate, superoxide synthesis and cell suicide in plant defence. Trends in Plant Science 2, 162–165.
5. Hayat, S., Ali, B. and Ahmad, A., 2007, Salicylic Acid: A Plant Hormone In: Salicylic Acid: Biosynthesis, Metabolism and Physiological Role in Plants, Eds. Hayat, S. and Ahmad, A., Springer Netherlands. pp. 1-14.
6. Heidel AJ, Clarke JD, Antonovics J, Dong X. 2004. Fitness costs of mutations affecting the systemic acquired resistance pathway in Arabidopsis thaliana. Genetics 168, 2197–2206.
7. Janda T., G. Szalai, I. Tari, E. Paldi, (1999). Hydroponic treatment with salicylic acid decrease the effects of chilling injury in maize (Zea mays L.) plants, Planta 208: 175–180.
8. Larkindale J, Hall JD, Knight MR, Vierling E. 2005. Heat stress phenotypes of Arabidopsis mutants implicate multiple signaling pathways in the acquisition of thermotolerance. Plant Physiology 138, 882–897.
9. Martinez C, Pons E, Prats G, Leon J. 2004. Salicylic acid regulates flowering time and links defence responses and reproductive development. The Plant Journal 37, 209–217.
10. Mateo, A., Funck, D., Mühlenbock, P., Kular, B., Mullineaux, P.M. and Karpinski, S., 2006. Controlled levels of salicylic acid are required for optimal photosynthesis and redox homeostasis. Journal of Experimental Botany, 57(8), pp.1795-1807.
11. McDowell JM, Dangl JL. 2000. Signal transduction in the plant immune response. Trends in Biochemical Sciences 25, 79–82.
12. Mishra, D. K. and Mishra, H. R., 2006, Growth and flowering response of china aster (Callistephus chinensis L. Nees) to paclobutrazol. J. Orn. Hort., 9(1): 63-65
13. Padmapriya, S. and Chezhiyan, N., 2002, Influence of gibberllic acid and certain other chemicals on flowering characters of chrysanthemum (Dendranthema grandiflora) cultivars. South Indian Hort., 50(4-6): 437-443.
14. Ramesh, K. M., 1999, Effect of certain growth substances and SA on growth and yield of china aster (Callistephus chinensis L. Nees. M.Sc.Thesis, Tamilnadu Agric. Univ., Coimbatore (India).
15. Rao M.V., G. Paliyath, D.P. Ormrod, D.P. Murr, C.B. Watkins, (1997). Influence of salicylic acid on H2O2 production, oxidative stress and H2O2 metabolizing enzymes, Plant Physiol. 115: 137–149.
16. Raskin, I. (1992) Role of salicylic acid in plants. Ann. Rev. Plant Physiol. Plant Mol. Biol. 43, 439–463.
17. Ryals J, Lawton KA, Delaney TP, Friedrich L, Kessmann H, Neuenschwander U, Uknes S, Vernooij B, Weymann K. 1995. Signal transduction in systemic acquired resistance. Proceedings of the National Academy of Sciences, USA 92, 4202–4205.
18. Sairam, R.K., Srivastava, G.C., Agarwal, S. and Meena, R.C., 2005. Differences in antioxidant activity in response to salinity stress in tolerant and susceptible wheat genotypes. Biologia Plantarum, 49(1), pp.85-91.
19. Scott IM, Clarke SM, Wood JE, Mur LA. 2004. Salicylate accumulation inhibits growth at chilling temperature in Arabidopsis. Plant Physiology 135, 1040–1049.