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Effect of NAA and salt Stress (NaCl) on Early Seedling Growth of Wheat Cultivars (*Triticum aestivum* L.)

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Abstract

In this work ,the effect of different concentrations of NAA on the growth parameters of wheat seedlings grown under saline conditions were studied.Salt stress decreased the germination percentage,plumule,radicle length as well as seedling fresh and dry weight.NAA increased seedling length,seedling fresh and dry weight but did not influence as much on germination percentage. LOKMAN cultivar showed high seed germination percentage, radicle length and plumule length in comparison to other cultivars while P.B.W-343 cultivar had high seedling length.

Keywords: NAA, Salinity stress, Growth parameters, Wheat.

Introduction

Salinity is one of the most important problems in the agriculture areas of the world. Nearly 20 % of the world's cultivated area and nearly half of the world's irrigated lands are affected by salinity.Salinity occurs through natural and human induced activities that results in the accumulation of soluble salt in soil and the problem of soil salinity is expected to boost in future with the progress of decertification process and greenhouse effect (Basra *et. al;* (2005). The salt affected soil contain excess salts which affects plants by decreasing the osmotic potential of the soil solution (osmotic stress), interfering with normal nutrient uptake , inducing ionic toxicity and associating nutrient imbalance.Poor germination and seedling establishment are the results of soil salinity which adversely affects growth and development of crops and results into low agricultural productions.

Review of Literature

Higher NaCl concentrations in soil inhibits germination of wheat seedlings, Plant height, plant weights and chlorophyll, protein and carbohydrate contents (Abdul AL-Razak H,2015). Physiological treatments to improve seed germination and seedling emergence under various stress condition have been intensively investigated and it is thought that the depressive effect of salinity in germination could be related to a decline in endogenous levels on hormones. Plant hormones are naturally occurring, small, organic molecules that have important regulatory roles in plant growth and developmental processes (Camara et al., 2018) Presoaking seeds with several plants growth regulates such as NAA may increase the germination ability of seeds and seedling vigour in a wide range of plants.(Balestri and Bertini ;2003).Some authors suggested that by the use of growth regulators the harmful effect of salinity is lowered as the external application of growth hormones optimize physical metabolism conditions for germination . It is also possible that under high salt concentration naturally present hormone may be suppressed and that seed soaking with plant growth regulators supplies sufficient hormones for normal growth (Ashraf et al.,2002). Priming of seeds with the optimal concentrations of phytohormones is reported to effectively improve seed germination and growth performance in many crop species under normal and salinity stress conditions. Phytohormones commonly used for the purpose of seed priming are auxins (IAA, IBA &NAA), gibberellins (GA),abscisic acid and kinetin. So in the present investigation the influence of NAA on early seedling growth of wheat seeds subjected to salinity stress studied.

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Aim of the Study

To study Effect of NAA and salt stress (NaCl) on Early Seedling Growth of Wheat Cultivars (Triticum aestivumL.)

Material and Methods

This experiment was conducted during rabi season of 2017-2018 in Department of Botany, R.B.S. College, Agra, in which three varieties of Triticumaestivum i.e. H.D-343, LOKMAN and P.B.W-373 were investigated under different concentrations of NAA in both saline and non-saline conditions.Firstly seeds were sterilized with 0.5. % NaOCl (Sodium hypochlorite) solution for 1 minute and thoroughly washed in sterilized water before use in the experiment. Seeds were treated with three levels of salinity (0,50 and 100 mm) and two levels of NAA (0 and 1 mgL^{-1}) and germinated in sterilized petri plates .Seeds were germinated under growth chambers at 25°C and when there is a emergence of radicle from the seed coat ,it was considered germinated .The final germination percentage was taken after 240 hrs and seedling fresh weight was taken immediately at that time , seedling dry weight were evaluated after 48hrs in an oven at 80°C .For measurement of radicle and plumule length the seeds of each replicate were retained at the end of the experiment.

Results

Salinity affected adversely the growth parameters such as germination %, plumule and radicle length, seedling fresh and dry weight .Among the three cultivars under investigation LOKMAN was the better performed at the highest salinity level, P.B.W-373 showed the maximum reduction in all the parameters studied.

Germination

In the case of germination percentage it is quite evident from the data that cultivar LOKMAN had showed good resistance towards salinity as it was 92 % under treatment of 50mm (92.92 % of control) and 34 % under treatment of 100 mm NaCl (84.84 % of control) while in the presence of NAA it shows remarkably good performance, in the treatment of 1mgL^{-1} NAA and 50 mm NaCl as well as 100 mm NaCl the germination percentage was 93 % and 88 % respectively. Among the other two varieties , cultivar P.B.W -343 was worst performer as its germination percentage were 80 % (83.33 %of control) and 70 % (72 % of control) under treatment of 50mm and 100 mm NaCl .In the case of combined treatment of NAA and NaCl it was 82 %(86.31 % of control) and 78 %(82.10 % of control) under treatment of 1 mgL^{-1} NAA with 50 mm NaCl and 1mgL^{-1} NAA with 100nn NaCl respectively.Cultivar H.D-343 was 90 % (92.78 % of con78 % (80.41 % of control) under the different salinity stress while under combined treatment it was 91 5 (91.91 % of control) and 80 %(80.80 % of control).

Seedling Length

Whether there is a case of plumule length or radicle length cultivar LOKMAN was the best performer in both the treatments i.e. under salinity stress as well as in the combined treatment of salinity and NAA .In the case of salinity treatment the plumule length was 8.28mm(88.08 % of control) and 6.56 mm (69.78 % of control) while the radicle length was 7.36 mm (95.83 % of control) and 5.38 mm (66.41 % of control) under the combined treatment of 1mgL^{-1} with 50mm and 100 mm NaCl respectively . Cultivar P.B.W -373 did not show any resistance against the salinity nor individually neither in combined treatment with NAA , which is proved by its performance its plumule length was 7.98 mm (87.69 % of control) and 6.10mm(67.03 % of control) under treatment of 50mm and 100 mm NaCl. While under combined treatment of 1mgL^{-1} NAA with 50 mm and 100 mm NaCl ,its plumule length was 8.76 mm (92.60 % of control) and 6.88 mm(72.72 % of control) respectively . In the case H.D-343 cultivar the plumule length were 8.15 mm and 6.30 mm under salinity stress and it was 9.02 mm and 7.00 mm under combined treatment of 1mgL^{-1} with 50 mm and 100 mm NaCl respectively.

Seedling Fresh and Dry Weight

Application of NAA had reduced the harmful effect of salinity in all the three cultivars under investigation which is quite evident from the fact that all the cultivar whether it is P.B.W-373 or H.D-343 showed good performance .When they are treated with NAA under salinity stress. The best performance was showed by cultivar LOKMAN its seedling fresh weight under salinity treatment was 1.24 gm(91.17 % to control) and 1.07 gm(78.67 % of control) and when treated with both NAA and NaCl it was 1.36 gm(94.44 % of control) and 1.14 gm(79.16 % of control).In the case of seedling dry weight also cultivar LOKMAN was best , under only salinity stress it was 0.064 gm(84.21 % of control) and 0.049 gm(64.47 % of control) and under treatment of both NAA and NaCl it was 0.068 gm(86.07 % of control) and 0.054 gm(68.35 % of control).

Discussion/Conclusion

The results of the present investigation suggest that salinity reduced the germinability and growth of seeds.Application of NAA was beneficial in alleviating the adverse effects of salinity by enhancing the germination percentage ,its seedling length (plumule and radicle length) as well as its fresh and dry content. Some researchers observed that by the application of NAA the germination percentage as well as coleoptile elongation was positively correlated .It is also evident that by priming with NAA also shows positive effect under saline condition (Al-Halini and Hamada, 2001).All the cultivar investigated showed poor performance under salinity stress whether it was 50 mm or 100 mm . These results were in agreement of Xue et al.,(2004) who founds that high levels of salinity can significantly inhibit seed germination which is due to decreasing the availability to water or increasing in sodium chloride that increasing salinity concentrations in germination often cause osmotic and/or specific toxicity which may reduce or retard germination percentage. Balestri and Bestini (2003) observed that salinity stress affects seed germination as well as early seedling growth by decreasing the rate of water uptake (osmotic effect) and /or facilitating the intake of ions, which may change certain enzymatic or hormonal activities inside the seed (ion toxicity). It is interesting to see that seed germination percentage was increased in salinity conditions with presence of $1mgL^{-1}$NAA all the three cultivars investigated .According to Jamil and Rha (2007) growth promoters seed as NAA and GA_3 decreased or reduced the harmful effect of salinity because due to increased concentration of ions and salts the hormones present inside the seeds did not work according to their efficiency but when there is exogenous application of growth hormones the germination percentage as well as seedling growth is increased such physiological changes will results in a decrease in plant growth Naeem and Muhammud (2006).All the parameters studied are increased under combined treatment of NAA and NaCl in comparison to the individual effect of NaCl but under the individual treatment of 0 NaCl with 0 NAA as well as 0 NaCl with 1 mgL^{-1} NAA it shows reduced performance ,which is consistent with data obtained by previous authors with other plants(Shakirova*et al.,* 2003).

Note: I don't have further details about this topic my study consider review till 2018.

Tables:

Effect of N.A.A. on early seedling group of wheat cultivar (LOKMAN) under NaCl stress

Treatment		Germination%	Plumule length (mm)	Radicle length (mm)	Seedling fresh weight(g)
(mgL^{-1}) (N.A.A)	(mM) (Nacl)				
0	0	99	9.40	7.68	1.36
	50	92	8.28	7.36	1.24
	100	84	6.56	5.38	1.07
	0	100	9.82	7.98	1.44

1	50	93	9.20	7.51	1.30
	100	88	6.70	5.30	1.14

Effect of N.A.A. on early seedling group of wheat cultivar (H.D-343) under NaCl stress

Treatment		Germination%	Plumule length (mm)	Radicle length (mm)	Seedling fresh weight(g)
$mgL^{-1)}$ (N.A.A)	(mM) (Nacl)				
0	0	97	9.25	7.54	1.28
	50	90	8.15	7.18	1.10
	100	78	6.30	5.08	0.95
1	0	99	9.55	7.90	1.36
	50	91	9.02	7.36	1.24
	100	80	7.00	5.26	0.99

Effect of N.A.A. on early seedling group of wheat cultivar (P.B.W-373) under NaCl stress

Treatment		Germination %	Plumule length (mm)	Radicle length (mm)	Seedling fresh weight(g)
($mgL^{-1)}$ (N.A.A)	(mM) (Nacl)				
0	0	96	9.10	7.30	1.20
	50	80	7.98	7.02	1.04
	100	70	6.10	5.00	0.83
1	0	95	9.46	7.78	1.28
	50	82	8.76	7.12	1.09
	100	78	6.88	5.08	0.86

Conclusion

In many crop species seed germination and early seedling growth are the most sensitive stages to salinity stress. Exogenous application of plant growth hormone is shown to effectively improve germination as well as growth of various crop species. A number of growth hormone are used for reduced the harmful effect of salinity such as GA_3, IAA, Kinetin etc. In this study the positive effect of NAA hormone on growth parameters such as germination percentage, plumule and radicle length as well as seedling fresh and dry weight have been showed. It was observed that optimum level of auxin ($1mgL^{-1}$) could reduced negative effects salinity on seed germination parameters.

References

1. *Abdul AL-Razak H., AL-Saady, A. (2015).Germination and Growth of Wheat Plants (Triticumaestivum L.) Un-der Salt Stress. Journal of Pharmaceutical, Chemical and Biological Sciences. 3(3):416-420.*
2. *Ashraf,M.Y.,Afaf.R.Queresh,M.S.Sarwar,GandNaqvi,M.H.(2002).salinity induced changes in α-amylase and protease activities and associated metabolism in cotton varieties during germination and early seedling growth stages.Acta Physiological Plantarum,24(1):37-44.*
3. *Al-Hakini A.M.A and Hamada,A.M(2001). Counteraction of salinity stress on wheat plants by grain soaking in ascorbic acid , thiamin or sodium salicylate.Bid Plant,44:253-261.*
4. *Basra,S.M.A,Afzal,I,Rashid,R.A and Hameed,A (2005). Inducing salt tolerance in wheat by seed vigour enhancement techniques.Int.J.Biot.Biol.*
5. *Balestri,E and S . Bertini,2003 .Growth and development of posidonia oceanica seedlings treated with plant growth regulators:possible complications for meadow restoration .Aquat.Bot.,76:291-297.*
6. *Camara, M.C.; Vandenberghe, L.P.S.; Rodrigues, C.; Oliveira, J.D.; Faulds, C.; Bertrand, E.; Soccol, C.R. (2018) Current advances in gibberellic acid (GA3) production, patented technologies and potential applications. Planta2018, 248, 1–14*
7. *Jamil M E, Rha S. 2007.Gibberellic acid (GA3) enhances seed water uptake, germination and early seedling growth in sugar beet under salt stress. Pakistan .J Bio Sci. 10:4:654-658.*
8. *Naeem MA, Muhammud S. (2006). Effect of seed priming on growth of barley (Hordeumvulgare) by using brackish water in salt affected soils. Pak J Bot. 38:3: 613-622.*
9. *Shakirova, F.M., A.R. Shaikhutdinova, M.V. Bezrukova, R.A. Fakhrutdinova and D.R. Fatkhutdinova, (2003).Changes in the hormonal status of wheat seedlings induced by salicylic acid and salinity. Plant Sci., 164: 317-22.*
10. *Xue,Z:Zhi.D:Xue.G:Zhang,H:Zhao,Y and Xia,G(2004). Enhanced salt tolerance of transgenic wheat (Triticumaestivum L .) expressing a vacuolar Na^+/H^+antiporter gene with improved grain yield in saline salts soils in the field on a reduced levels of Na^+.Plant Sci. 167:849-859.*