SUMMARY

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Soil salinity has long been a big problem for mankind. In India about 7 million hectares (ha) of land is estimated to be afflicted by the problem of soil salinity and alkalinity, mainly in the Indo-Gangetic plains, arid areas of Rajasthan and Gujarat, black cotton soil region and coastal areas. The area under this problem has been increasing in extent greatly with the expansion of irrigation networks. And, if proper soil and water management practices along with introduction of irrigation and proper drainage are not adopted, the problem of soil salinity is likely to increase day-by-day (Yadav, 1981). In Gujarat about 3,04,582 ha of land lie under uncultivable conditions due to salinity. An increase in population demands an increase in agricultural production. With the development of soil science and the extended use of modern agricultural technology, man must meet challange of increasing food production and of using for agriculture, areas and sources of water formerly considered unsuitable for the purpose.

Paddy is one of the most widely cultivated cereal crops of India and it accounts for 40% of the total food grain production. In agriculture, ready germination of seeds and establishment of healthy seedlings are two important desirable features as the final crop producing

value of plants depends on the said processes. It has often been observed that paddy seeds fail to germinate under saline conditions and if at all they germinate, their percentage of germination is very low. The present studies were therefore, taken up with a view to finding out the various factors responsible for the failure of seeds of paddy (Oryza sativa L. var. GR-3) to germinate under saline condition and also to evolve some chemical treatments which would render the seeds readily germinable under saline condition.

It has been observed that 0.2 M NaCl highly reduces the rate and final percentage of germination. The germination of seeds was reduced to 22% by 0.2 M NaCl as compared to the cent per cent observed in the control. Hence, attempts were made to enhance the germination percentage of seeds at 0.2 M NaCl by treating them with various chemicals such as $CaCl_2$, succinic acid, proline, polyethylene glycol (PEG, 6000), kinetin and gibberellic acid (GA_3). Among different chemicals tried GA_3 (10 mg/l) was found to be the most effective in improving the percentage of germination of seeds. under the influence of salt. Hence, further studies were carried out employing 10 mg/l GA_3. To understand the mechanisms by which GA_3 stimulates germination of seeds and growth of seedlings under saline condition following studies were carried out :

1. Changes in the dry weight of endosperms of seeds during different stages of germination under different treatments.

2. Changes in the levels of various cellular constituents of endosperms of seeds viz. starch, total soluble sugars, reducing sugars, total nitrogen, total protein and phosphorus fractions during different stages of germination.

3. Changes in the levels of hydrolases viz. amylases (α and β), maltase, invertase, protease, phytase and ATPase in the endosperms of seeds during germination.

4. The isozyme pattern of amylases during germination.

5. The rate of respiration (O_2 uptake) and the activity of pyruvic-, α-ketoglutaric-, succinic- and glucose-6-phosphate dehydrogenases during germination.

It has been observed that there was a marked reduction in the dry weight of endosperms during the germination of seeds. No such significant reduction in the dry weight of endosperms was observed during the germination of seeds under the influence of salt. However, the treatment of seeds with GA_3 resulted in a greater loss in the dry weight of endosperms during germination of seeds under saline condition as compared to the control (salt alone). It has also been observed that NaCl inhibits the depletion of reserve food materials (starch, protein, phytin etc.) from endosperms of seeds by inhibiting the activities of amylases (α and β), maltase, invertase, protease, phytase and ATPase. Over and above this the respiratory processes of seeds have also been found adversely affected by salt resulting in lower activities of various dehydrogenases. Studies on the isozyme pattern of amylases during germination of seeds also suggest the inhibition of synthesis of enzymes by salt. Treatment of seeds with GA_3 brought about a slightly enhanced rate of depletion of reserve food materials from the endosperm under the influence of salt. The enhanced rate of depletion of food materials from the endosperm under the influence of GA_3 has been found taking place as a result of enhanced activity of various hydrolases. The rate of respiration and activity of dehydrogenases of seeds have also been found increased by GA_3 during germination under saline condition.

Thus, it has been found that GA_3 enhances the germination of seeds under the influence of salt by stimulating the activity of the said hydrolytic enzymes resulting in rapid degradation of stored food materials and mobilization of degraded materials from endosperm to the growing axis and also by increasing the rate of respiration. GA_3 has been found enhancing the activity of amylases during germination of seeds under the influence of salt by inducing the synthesis of isozymes.

It is concluded from the present studies that :

Sodium chloride inhibits the germination of seeds by reducing the rate of hydrolysis of stored food materials in the endosperm as evidenced from their levels, changes in the dry weight of endosperm and reduced activity of α-amylase, β-amylase, maltase, invertase, protease and phytase. The inhibition of germination of seeds by salt has also been found due to reduced rate of O_2 uptake and low activity of pyruvic-, α-ketoglutaric-, succinic- and glucose-6-phosphate dehydrogenases and ATPase. Salt has also been found inhibiting the synthesis of enzymes as evidenced by the isozyme pattern of amylases during germination of seeds. GA_3 enhances the germination of seeds under the toxic level of salt by

(i) slightly quickening the mobilization of stored food materials from the endosperm as evidenced by their levels in the endosperm and also the changes in dry weight of endosperm during germination,

(ii) quickening the hydrolysis of stored materials in the endosperm by enhancing the activity of the said hydrolases by stimulating their synthesis and/or inducing their isozymes,

(iii) enhancing the rate of O_2 uptake and activity of dehydrogenases and ATPase.

The inhibition of germination under saline condition may be due to -

(a) the inhibition of synthesis of gibberellin and other promoters of germination by salt as exogenously applied GA_3 could partially nullify the inhibitory effect of salt and bring about 88% germination of seeds,

(b) the high concentration of salt may be inducing the synthesis of inhibitor of germination viz. abscisic acid [and lowering the level of promoters] (Mizrahi <u>et al</u>., 1972).

Under these conditions exogenously supplied GA_3 may be counteracting the inhibitory effect of abscisic acid and/or increasing the endogenous level of promoters.

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