Physiological basis of yield variation in brassica juncea L. under the influence of nitrogen source and saline water irrigation

The present investigation was carried out on Brassica juncea cv RH-30 under screen house conditions to evaluate the interactive effect of salinity and nitrogen fertilizer on morpho-physiological, nitrogen in metabolism and quality characters. Before sowing of seeds the pots were supplied with nitrogen through different nitrogen sources i.e. nitrate, ammonical and combined forms having three levels (40, 80 and 120 kg ha-1). The desired salinity levels (ECe 0, 8 and 12 dSm-1) were obtained by adding Cl and SO4 salts of Na, Ca and Mg alongwith non-saline control. Salinity solutions were applied to plants at 35 and 55 DAS which corresponds to stage I and stage II. Subsequently sampling was done at 10 days after applying saline water irrigation. All growth parameters viz., dry weight of different plant parts, leaf area, relative growth rate and net assimilation rate decline under salinity at both stages. The combined and ammonical form of N exhibited minimum and maximum reduction under salinity levels (8 and 12 dSm-1). The application of higher level (120 kg ha-1) of nitrogen in combined and ammonical form resulted in maximum and minimum alleviation of the detrimental effect of salinity. Water relation parameters viz., relative water content, leaf water potential and leaf osmotic potential decreased at both sampling stages under saline condition. The maximum and minimum reduction was observed with combined and ammonical form of nitrogen, respectively. However, the application of 120 kg ha-1 combined and ammonical forms helped in maintaining maximum and minimum plant water status. Reduced water status under salinity resulted in decline photosynthetic rate, transpiration and stomatal conductance. The plants treated with nitrate and ammonical form of nitrogen showed minimum and maximum reduction salinity (8 and 12 dSM-1). The nitrate form of nitrogen (120 kg ha-1) proved better over other two forms in partial moderation of the gas exchange parameters. Biochemical concentration got altered by salinity at both stages. Total chlorophyll, carotenoid and starch declined significantly under salinity. However, maximum and minimum reduction were noticed with ammonical and combined form of nitrogen, respectively. Total soluble carbohydrates, proline and total free amino acids got accumulated. In contrst to the above effect, combined an, ammonical form of nitrogen exhibited maximum and minimum accumulation Linder salin, condition, Alleviation in-the decline of starch, total chlorophyll and carotenoids under salinity was maximum and minimum with combined and ammonical form of nitrogen, respectively. Likewise, minimum and maximum per cent accumulation of total Soluble carbohydrates, proline and free amino acids were observed was observed with higher level of nitrogen in combined and ammonical of form of nitrogen, respectively. Alongwith biochemical changes, enzymes of nitrogen metabolism (NR, NiR, GS, GOGAT and GDH) were inhibited with salinity treatment. The maximum and minimum inhibition in nitrate assimilation enzymes (NR and NiR) were noticed with ammonical and nitrate forms, respectively. The higher level of nitrate and ammonical forms of nitrogen (120 kg ha-1) resulted highest and lowest activities of NR and NiR. Besides enzymes of nitrate assimilation, the activities of ammonia assimilation enzymes (GS, GOGAT and GDH) also exhibited maximum and minimum inhibition with nitrate and ammonical forms, respectively. But the higher level of nitrogen (120 kg ha-1) significantly gave maximum and minimum activity with ammonical and nitrate forms of nitrogen. With saline treatment, different nutrient elements such as N, P, K, Mg got decreased in different plant parts. The maximum and minimum reduction were observed with ammonical and combined form of nitrogen, respectively while reverse was true for Ca, Na, Cl and SO4. Nitrogen application (120 kg ha-1) in combined form had been found to maintain highest concentrations of N. P, K, Mg and Ca, along with reduced conc. of Na, Cl and SO4. Siliquae and seed yield adversely affected with different levels of salinity at both sampling stages. The maximum and minimum reduction were observed with ammonical and combined forms of

nitrogen, respectively. Induced salt stress reduced the number of siliquae and yield per plant and this adverse effect was mitigated to the extent of maximum and minimum by higher level of nitrogen in combined and ammonical forms, respectively. The oil and protein content at harvest decreased with every increment in salinity at both stages. Reduction under salinity were maximum in ammonical form and minimum with combined form. The maximum and minimum increase in protein content in seed was observed using 120 kg ha-1 nitrogen with nitrate and ammonical form. The fatty acids composition of mustard seed at harvest showed sharp changes with salinity treatment at both s2nipling stages. With increasing salinity levels (8 and 12 dSm-l), oleic, linoleic, linoleic acids got increased while palmitic and erucic acids decreased. Under saline condition, maximum accumulation of oleic, linoleic and linolenic acids with combined form while minimum accumulation with ammonical form of nitrogen were observed. However, the accumulation of palmitic and erucie acids contents was maximum and minimum with ammonical and combined form of nitrogen, respectively. Application of higher level of (120 kg ha-1) nitrogen in combined form under salt stress brought highest accumulation of oleic, linoleic and linolenic acids while plamitic and erucic acids showed further declined. Under salinity, the glucosinolate content in seed increased at both sampling stages. Its content was highest and lowest with ammonical and combined form of nitrogen. The maximum and minimum accumulation of glucoseinolate content under salinity was observed with higher level of nitrogen, respectively. Mostly combined form of nitrogen (120 kg ha-1) had edge over other two form in Partially alleviating the deleterious effect of salinity on morpho-Physiological, biochemical, yield and quality characters in Brassica juncea.