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Original Research Article

Foliar Soil and Agricultural Application of Gibberellic Acid to Alleviate the Effect of Nickel Sulphate Stress *Brassica napus* L

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Abstract

There are 150 species of the genus brassica that are grown globally as oilseed crops or vegetables. Mustard plants belong to the family brassicaceae. Oil is obtained from mustard seeds, their leaves are edible and can be consumed as mustard greens. Gibberellic acid (GA) is a hormone or growth regulator present in variable amounts in all sections of plants. The presence of heavy metals has turned into a problem because of their harmful results on plants even at low concentration. The present study comprises of a pot experiment that was perform at the Old Botanical Garden, University of Agriculture Faisalabad to examine the effect of exogenous supplication of gibberellic acid on development and various morphological parameters of mustard (*Brassica napus* L.) within $NiSo_4$ tensity on two varieties (super canola and sherilla). The experiment was designed CRD (completely randomized design) by factorial arrangement and 3 replications. A 300 µM nickel sulphate stress was applied and to overcome the effect of metal stress a foliar application of (0.25 mM) gibberellic acid was applied. The samples were dividing into two different sampling bags with three replicates. Plastic zipper bags containing fresh samples were kept in the freezer for different biochemical analysis like chlorophyll and carotenoids and the data were collected for the determination of various morpho-physiological parameters. While the remaining samples were placed in the oven for dry analysis for samples Na^+, K^+ and Ca^+. These parameters were analyzed by using CO-STAT software program.

Keywords: Sulphate stress, gibberellic acid, zipper bags, chlorophyll.

INTRODUCTION

There are around 30 species in the genus Brassica (Brassicaceae), as well as several variations and hybrids. Several important agricultural species, such as those utilised for human food, animal feed, spices, oil production, and biofuel, are among them. This genus includes numerous Brassica oleracea cultivars that are often consumed by humans (like cabbages, broccoli, cauliflower and Brussel sprouts). Carotenoids, tocopherols, other vital elements, sugars, and amino acids are among the nutrients they contain [1-3].

Several Brassica species are known metal accumulators and have been evaluated as potential phytoextraction plants. The fact that some of these plants can accumulate relatively high amounts of toxic metals, without visible symptoms, and are also food crops, leads to potential contamination of the food chain and this must be considered in any phytoremediation process [4, 5]. The potential use of Brassica species in phytoremediation (mainly phytoextraction) stems from its intrinsic tolerance to heavy metals and considerable above-ground biomass production [6, 7].

Brassica juncea L. is known as very important crop producing oil seed all over the world after groundnuts and soya bean. Brassica juncea L. is the one member of large family known as brassicaceae. Due to its comestible and medical uses and for its oil content, it is known as important crop. In world, Asian continent produces about 7% of total eatable oil and thus rank second in world. In plants, gibberellic acid (GA) is an essential endogenous growth regulator that regulates plant growth and development. Seed germination, stem elongation, leaf growth, blooming, and fruit development are all aided by GA. The use of GA-like compounds to modify these processes is a frequent agronomic technique. Although a growing number of possible components, including as Ca^{2+}, calmodulin, protein kinases, heterotrimeric G-proteins, and numerous promoter cis-elements and transcription factors, including GAMYB, have been discovered, the molecular processes involved in GA signaling are still unknown [8, 9]. Much progress has recently been made in fully comprehending the mechanism of GA signaling. In the production of GA in barley stems, for example, indole-3-aceticacid (IAA) is needed abscisic acid catabolism is enhanced by GA application and stimulates plant development by causing the DELLA proteins to disappear, between dicots and monocots is substantially conserved (Fleet and Sun, 2005). Exogenous GA, on the other hand, has been shown to counteract the inhibitory impact of abiotic stress. GA, for example, can improve salt tolerance in Arabidopsis by regulating the amount of salicylic acid and GA can also reduce heavy metal buildup in rice shoots and reduce the negative effects of Cd^{2+} and Pb^{2+} on broad bean and lupin plants [10-13].

MATERIAL AND METHODS

The field work was undertaken to investigate the exogenous influence of gibberellic acid on two *Brassica napus* L. canola crop varieties organism under threat from nickel. After about 30 days of seedling arrival, the stress of nickel sulphate was applied to both varieties, and the next level of stress was applied the one week of first stress application. Nickel was administered at a A 300 µM concentration and gibberellic acid was added as a cure with a concentration of 0.25 mM.

Sowing and Growth Medium

Both variety seeds (super canola and sherrela) were obtain from the Faisalabad institute of Ayoub Agriculture Study and deposited in the plastic pots. Pots have a hole at the bottom and a thin cotton fabric covered it. Every pot had 8kg 0 of top up dirt. Stress was added after germination on rooting substrate, while each pot produced eight seedlings of equal size.

Metal and hormone sources

Water distilled that were present at the Faisalabad University of Agriculture was used for the extraction of plants. Nickel sulphate stress in quantity 300 µM and gibberellic acid in quantity 0.25 mM in specific quantity were taken from our university's botany department and make the 12-litter solution for 24 containers. Gibberellic acid solution for exogenously used often made in one litter. Even takes nutrient solution from department of botany.

Harvest

Plants were harvested after 40 days of therapy and experiments were carried out in a completely randomized manner. Following parameters were studied.

Growth parameters:

Shoot length and root length (cm)

The length of the shoot was measured from bottom to top of the plant, while the root length was calculated with a scale meter from the shoot base to the root end.

Shoot and root fresh weight (g)

Fresh weights for shooting the rooting were intended using electronic balance.

Shoot and root dry weight (g)

Dry masses of roots and shoots were determined for 72 hours during the samples after oven (at 65oC).

No. of leaves

To count no. of leaves, leaves were totaled properly, and their mean values were estimated.

Biochemical parameters

Chlorophyll content

Absorption of chlorophyll a and b was noticed at 663 nm, 645 nm and 480 nm by using spectrophotometer (UV-3802, UNIC, Shanghai, china) through procedure whereas carotenoids were noticed at 480 nm.

Malondialdehyde (MDA)

Chromium convinced oxidative injury to membranes remaine assessed by measuring the quantity of malodialdehyde in tissues by subsequent procedures defined through certain changes. 0.5 g of fresh leaf substantial remained standardized in 3 ml of 5% (w/v) TCA (trichloro acetic) at 4ºC.

Statistical analysis

For each attribute the (analysis of variance) ANOVA, in a completely randomized design was calculated by a computer software.

RESULTS AND DICUSSIONS

Shoot fresh weight (g)

Application of metal stress caused significant ($P \leq 0.05$) reduction in shoot fresh weight of both genotypes. Maximum reduction in shoot fresh weight was observed in CV.

Root fresh weight (g)

Application of metal stress caused significant ($P \leq 0.05$) reduction in root fresh weight of both genotypes. Maximum reduction root fresh weight was observed in cv.

Plant fresh weight (g)

Application of metal stress caused significant ($P \leq 0.05$) reduction in plant fresh weight of both genotypes. Maximum reduction plant fresh weight was observed in cv [14].

Shoot dry weight (g)

Application of metal stress caused non-significant reduction in shoot dry weight of both genotypes Maximum reduction shoot dry weight was observed in cv. Sherilla under stress condition when 0.25 mM GA3 was applied [15].

Root dry weight (g)

Application of metal stress caused significant ($P \leq 0.05$) reduction in root dry weight of both genotypes. Maximum reduction root dry weight was observed in cv. Sherilla under stress condition when 0 mM GA3 was applied.

Plant dry weight (g)

Application of metal stress caused significant ($P \leq 0.05$) reduction in plant dry weight of both genotypes. Maximum reduction plant dry weight was observed in cv. Super canola under stress condition when 0.25 mM GA3 was applied [16].

Number of leaves

Application of metal stress caused significant ($p \leq 0.05$) reduction in number of leaves of both genotypes. Maximum reduction number of leaves was observed in cv. Super canola under stress condition when 0.25 mM GA3 was applied [17].

Leaf length (cm)

Application of metal stress caused non-significant reduction in leaf length of both genotypes. Maximum reduction leaf length was observed in cv. Super canola under stress condition when 0.25 mM and 0 mM GA3 was applied [18].

Leaf width (cm)

Application of metal stress caused significant ($p \leq 0.05$) reduction in leaf width of both genotypes. Maximum reduction leaf width was observed in cv.

Root length (cm)

Application of metal stress caused non-significant reduction in root length of both genotypes. Maximum reduction root length was observed in cv.

Shoot length (cm)

Application of metal stress caused non-significant reduction in shoot length of both genotypes. Maximum reduction shoot length was observed in cv. Super canola under stress condition when 0.25 mM GA3 was applied. Whereas, minimum reduction was observed in cv. Sherilla under stress condition when 0 mM GA3 was applied.

Plant height (cm)

Application of metal stress caused non-significant reduction in plant height of both genotypes. Maximum reduction plant height was observed in cv. Super canola under stress condition when 0.25 mM GA3 was applied. Whereas, minimum reduction was observed in cv. Sherilla under stress condition when 0.25 mM GA3 was applied.

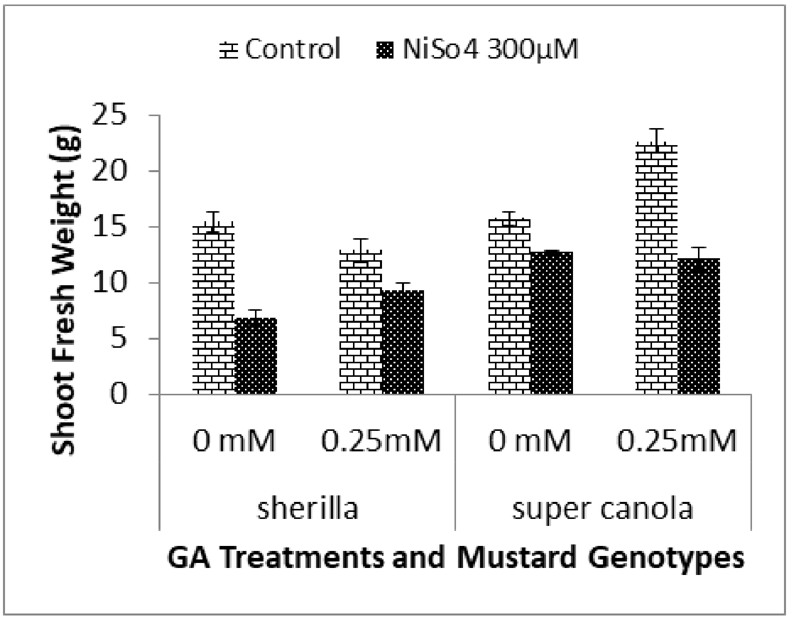

Fig-1: Application of metal stress caused in shoot fresh weight

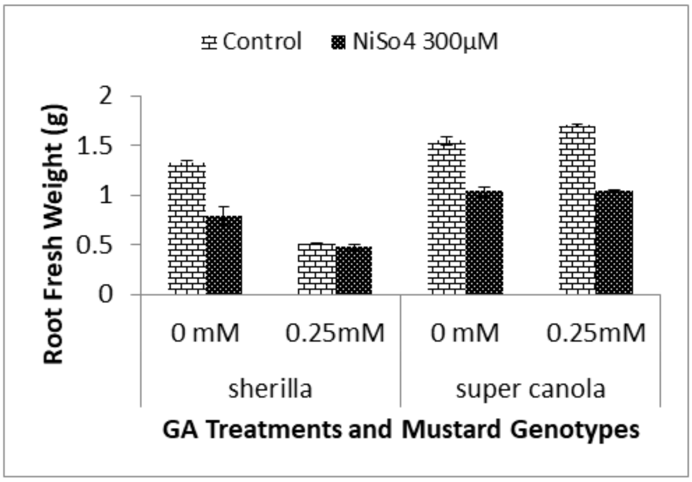

Fig-2: Application of metal stress caused in root fresh weight

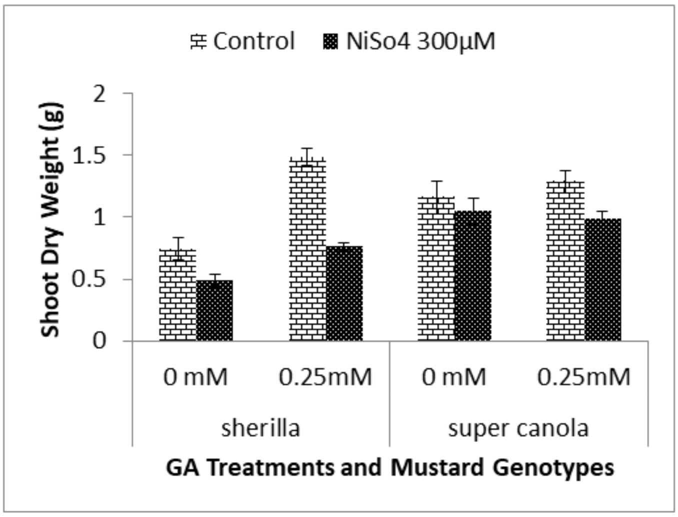

Fig 3: Application of metal stress caused in shoot dry weight

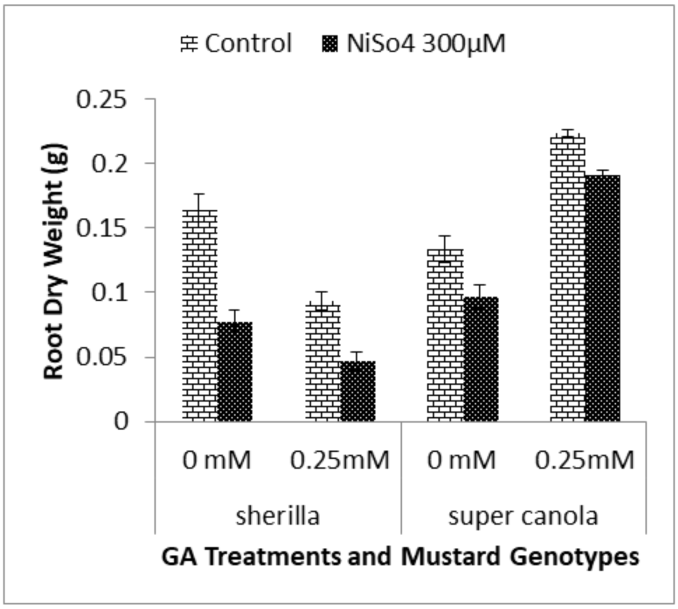

Fig 4: Application of metal stress caused in root dry weight

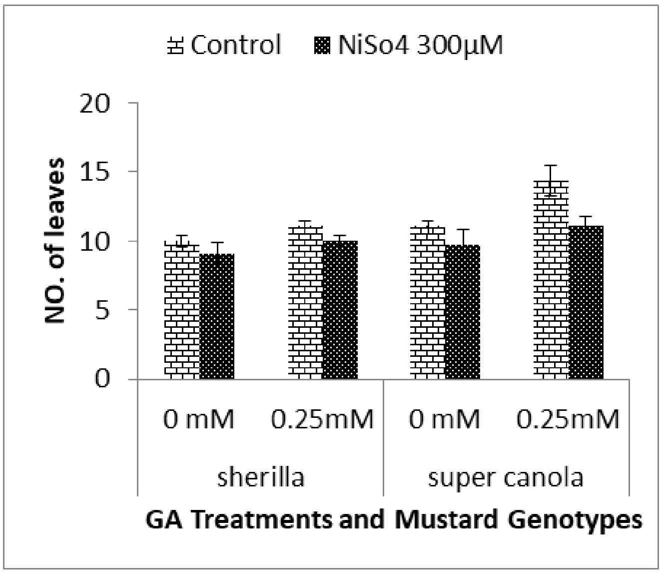

Fig 5: Application of metal stress caused in leaves

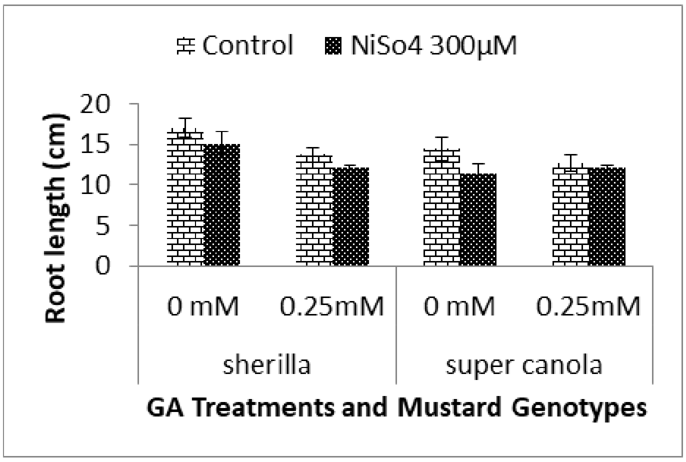

Fig 6: Application of metal stress caused in root length

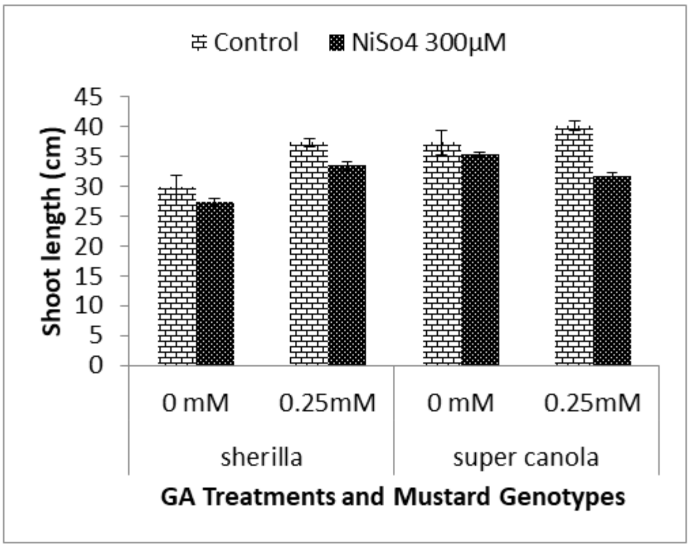

Fig 7: Application of metal stress caused in shoot length

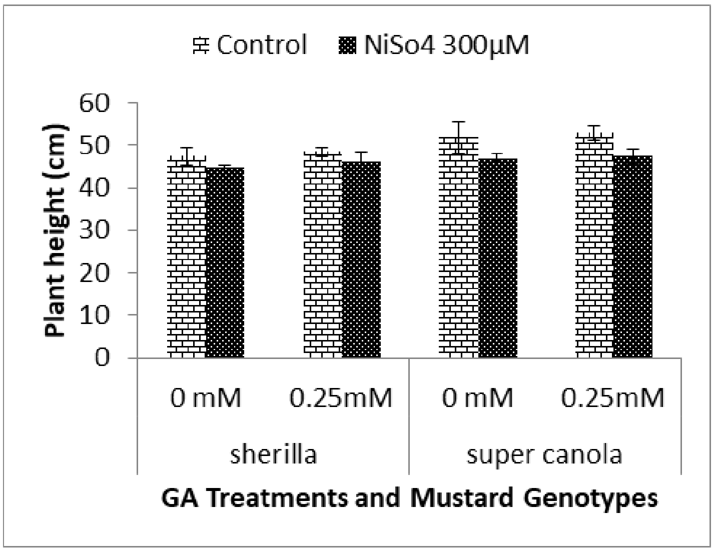

Fig 8: Application of metal stress caused in height

The present investigation shows result that non-significant salt stress cause reduction in carotenoids. These findings matched those of earlier research. The reason behind the decrease in carotenoids might be that it can destroy leaf stomata. The outcomes of the current research are as follows: significant salt stress cause reduction in SOD, POD. The findings matched those of previous. Abrupt decrease at a greater level, Severe oxidative damage might cause Ni stress. The present investigation result showed that non-significant salt stress cause reduction in total soluble protein. The present investigation result showed that non-significant salt stress cause reduction in total amino acid. These findings matched those of the previous study also protein content was observed to be lower in nickel treated seedlings, presumably due to a reduction in amino acid metabolism [19, 20].

The current study found that severe salt stress causes a non-significant rise in enzymatic antioxidant parameters such as H2O2 and MDA in mustard plants. These results were in accordance with the findings of which rises in mustard Ni-treated plants and results of malondialdehyde content decreased that showed resemblances with the work. The rise in enzymatic antioxidant levels might be due to the fact that Ni disrupts mineral nutrient balance and, in severe situations, decreases the concentration of important mineral elements in plant tissues such as potassium, nitrogen, and phosphorus [21-23].

CONCLUSION

Heavy metal cause cereal crop injury. Salt stress is the most important aspect that inhibit the plant development and productivity of crops. Salt stress because an adverse effect in crop production lowers the rate of seed germination, all other physiological, morphological and biochemical processes. To reduce this negative effect in crop to use different hormones. Gibberellic acid is also known as plant growth regulator. The use of GA_3 as a foliar application increase the productivity in crops. The also enhance all physiological, morphological and biochemical parameters under salt stress.

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