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Organic Fertilizer Increases the Growth and Productivity of *Beta vulgaris* L.: An Experimental Study of the Arid Region of Mardan, KP, Pakistan

Shiraz Khan[a], Abdur Rauf[a], Syed Abidullah*[a,b,c] Farooq Jan[a], Ikramullah Khan[a] Muhammad Khalid[d], Sundus Ali[a] and Ruby Wali Khan[a]

[a]Department of Botany Abdul Wali Khan University, Khyber Pakhtunkhwa, Mardan-23200, Pakistan
[b]Department of Botany, Government Degree College Wari Dir Upper, Khyber Pakhtunkhwa, Pakistan
[c]Department of Botany, Faculty of Sciences, Mohi-ud-Din Islamic University, Nerian Sharif, AJ&K, Pakistan
[d]Key Laboratory of Urban Agriculture, School of Agriculture and Biology, Shanghai Jiao Tong University, Shanghai, 200240, China

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Abstract. The growth and productivity of different varieties of beetroot *Beta vulgaris* were examined in presence of urea, nitrogen, phosphorus, potassium, compost and salt during the field trial, and the chemical constitution of three different varieties, dark red, ruby queen and detroit-2 was identified quantitatively by spectrophotometer. Ruby queen shows maximum growth as compared to dark red and detroit-2. The application of urea, nitrogen, phosphate, potassium and compost reduces the amount of catalase and total anti-oxidant enzymic potensial while increasing the concentrations of proteins, lipids, and sugars, with high growth and yield. Maximum growth was observed in the presence of urea, while the application of salt inhibited growth in all three varieties. In the nitrogen, phosphorus, potassium and compost-treated plants, nitrogen, phosphorus, and potassium show more growth as compared to compost. Similarly, metabolic contents such as IAA, chlorophyll and phenolic, were found in high concentrations in urea, nitrogen, phosphorus, potassium and compost-treated plants as compared to salt-treated plants.

Keywords: compost, organic, productivity

Introduction

Soil fertility declined day by day, due to continuous cultivation and insufficient supply of nutrients (Rop *et al*., 2018). To avoid this factor farmers use different types of fertilizer, like nitrogen, phosphorus, potassium and urea to increase and tolerate crop yields (Rop *et al*., 2018). Inorganic and organic fertilizers are sources of mineral elements which are important for the growth and development of plants. These fertilizers are required in maximum amounts for effective growth (Masarirambi *et al*., 2012). According to a recent study of the US crop production report, fertilizers are mostly used to increase the productivity of plants by upto 50% around the world, while they can reduce the crop's production by upto 40-60% without nitrogen, phosphorus and potassium. Nitrogen element in nitrogen, phosphorus and potassium (NPK) fertilizer prepares amino acids, nucleic acids, nucleotides and chlorophyll in plants, while the element phosphorus store energy in the plant cell and play a key role in many cellular processes of respiration, photosynthesis, energy storage, maturation and cell division. The potassium element in the NPK fertilizer act as an enzyme activator and helps in the transport of assimilation (Jayaweera and Mikkelsen, 1991) and polymer nano-composite fertilizer formulation has the potential to improve nutrient use efficiency (Rop *et al*., 2018), while nitrogen promotes somatic growth and green colouration of vegetation (Masarirambi *et al*., 2012).

Beta vulgaris L. is an herbaceous leafy vegetable commonly called Beet root, belonging to the family Amaranthaceae. Beet root originated in Germany (Devi *et al*., 2016; Sidra *et al*., 2016; Casierra-Posada *et al*., 2015; Ijoyah *et al*., 2008). Beet root is biennials, usually grown annually and produces green max and their growing swollen roots during the first growing season (Casierra-Posada *et al*., 2015). It is used as a traditional vegetable (dish), and salads to accompany meat and fish, pies, canning and pickling and it's a good source of carbohydrates, minerals and protein which has high levels of vitamin B1 and micro-nutrients (Shuaibu, 2021; Casierra-Posada *et al*., 2015). Beet roots are also

*Author for correspondence; E-mail: charmang5@gmail.com; syedabid821@yahoo.com

used as traditional medicine for the treatment of leukemia, esophagus, glands, head, intestines, prostate, rectum anemia and uterus ulcers. Their juice is mostly used as a stimulant for the immune system, to prevent breast cancer, blood purification, heart and digestive system (Zardi-Bergaoui *et al*., 2017). The leaves of Beet roots contain some amounts of vitamins, nitrogen-containing pigments, and minerals (Nisa *et al*., 2021; Sarfaraz *et al*., 2021; Casierra-Posada *et al*., 2015; Pyo *et al*., 2004).

In Pakistan, different varieties of Beetroots are growing across the country (Imran *et al*., 2019; Iqbal and Saleem, 2015; Ahmad *et al*., 2012). It grows best under cold conditions, the optimum soil pH for beets is 6.0 to 6.8 but a pH upto 7.6 can be tolerated and can be grown successfully almost all around the year. The best quality beetroot is obtained if it is cultivated under cool, moist conditions. Beet seeds germinate best in soil temperatures between 10 °C and 29.4 °C but will germinate between 4.4 °C and 35 °C. Fall planting should take place 8 to 10 weeks before the first expected frost (Sidra *et al*., 2016). The maximum agro-biological efficiency of Beet root productivity was observed for a commercial root yield of 22.68 tons/ha with 44.92 tons per ha of hairy wood rose biomass (Dos *et al*., 2021). The area under beet root cultivation in Pakistan is about 1 million hectares of land under cane and beet in four provinces. Punjab and Sindh contribute about 90 % of the total area and production (Pakistan Agricultural Research Council).

The overall aim and objective of this study is to find a high-productivity variety of beetroot. To determine the effect of organic fertiliser on sugar beet growth, production and quality. To identify a suitable variety of beetroot and to investigate the performance of dark red, ruby queen and detroit-2 varieties under various levels. To monitor the amount of catalase, total antioxidants, proteins, lipids, sugars, IAA, chlorophyll, phenolic contents through the application of urea, NPK and compost and salt on the growth and productivity of *Beta vulgaris* L. varieties in the arid region of Mardan, KP, Pakistan.

Materials and Methods

Synthesis of fertilizers composition. In this experiment, about 588 g/L letter of DAP was dissolved in distilled water at 20 °C temperature at normal pH, using the standard method (Rop *et al*., 2018) with some modifications. Salt, nitrogen, phosphorus, potassium and compost were weighed and added to one container at the ratio of 20:20:20:20 and added to the soil, according to the soil instruction given by the company. The desired concentration of fertilizers was added to each spot accordingly. Urea or diammonium phosphate (DAP) containing 46% P_2O_5, 20% P and 18% nitrogen were purchased from the local market Mardan, while NPK (organic fertilizer was ordered from Komeco Fertilizer Company Limited (Komeco B. V. Holland). The salts were obtained from the University Research Lab, whereas all other substances were analytical grade.

Soil characterization. The total minerals and nitrogen were resolute by using the stranded method of (Bremner, 1965) with some modifications. The soil pH was determined by using the same method of (Rop *et al*., 2018).

Soil sampling and data collection. A field experiment was conducted in a Tobacco Research Station (TRS) 34.2336409, 72.0013485 located in Khyber Pakhtunkhwa, Mardan, Pakistan. This research center was selected because most of the elemental and diagnostic analyses of soils were already known by many researcher and scientists which are present in a preprint form in different journals. Field humidity and annual temperature of the area are generally similar, depending on the mean temperature and the range of human population. Most of the crops grown in this area are *Saccharum officinarum* (sugarcane), *Brassica oleracea* (wild mustard), *Brassica juncea*, *Brassica campestris* (mustrads) *Lycopaersicon esculentum* (tomatoes), *Daucus carota* (Carrots), *Allum fistulosum* (onions), *Phaseolus vulgaris*, (beans), *Zea mays* (maize) and many more. Before the experiment, the surface litter that included leaves, sticks, stumps and other materials was removed softly to expose the surface soil. After that, the soils were dug with the help of a hoe, hatchet, rake and fork. After two days the desired seed was sown in the soils by standard methods.

Field experiment. A field experiment was conducted in the above mentioned research station. In this work *Beta vulgaris* L. was sown in the soil according to the standard protocol (October, 2019). The growth and development of the beet root were evaluated over 8 weeks on a four-block experimental design according to the protocol of (Khan *et al*., 2019) and plants without treatment were used as control. After 30 days of the experiment, the plant was harvested and different parameters such as shoot length, root length, fresh weight of both shoot and root, dry weight of shoot and root were measured and weight. Moreover, two experimental works have been conducted in the Plant Physiology Laboratory, Abdul Wali Khan University, and Research Center Mardan to explore the influence of fertilizers on the development of seeds grow and the biochemical and physiological effects of different varieties of *Beta vulgaris* L.

Total sugar. Total sugar content was measured by (Yemm and Willis, 1954) method. Leaf extract was set by grinding 0.5 g fresh leaf sample, which was dissolved in 10 mL of distilled water and the sample was centrifuged at 3000 rpm for 5 minutes. About 0.1 mL of the supernatant was taken from the sample and 1 mL of 80% phenol was added to it, and the sample was further incubated for 10 min. After incubation, 5 mL of concentrated H_2SO_4 was added and again the sample was incubated for an additional one hour. Optical density was measured at 485 nm against blank (benedict solution).

Chlorophyll. Chlorophylls were measured with the help of the Su and Naeem methods (Naeem *et al*., 2022; Su *et al*., 2010), the fresh leaves of each selected plant were weighed carefully and the leaves were treated with 3 mL (80%) acetone, which was mixed with a certain amount of marinated sand and centrifuged at 1000 rpm for 5 min. The pieces were washed 3 times with 1 mL (80%) acetone. The supernatants were then incubated with 7 mL of acetone and the optical densities of these solutions were detected at 663 nm, 645 nm, 510 nm and 480 nm respectively.

Equations:

$$\text{Chlorophyll a } (\frac{mg}{g} = \frac{12.3D663 - 0.86\ D645}{dx1000xw} \text{ .... (a)}$$

$$\text{Chlorophyll b } (\frac{mg}{g} = \frac{12.3D645 - 0.86\ D663}{dx1000xw} \text{ .... (b)}$$

$$\text{Total no. chlorophyll } (\frac{mg}{g} = (Ch.a) + (Ch.\ b) \text{ .... (c)}$$

$$\text{Cartenoid content a } (\frac{mg}{g} = \frac{7.6\ D4480 - 1.49\ D510}{dx1000xw} \text{ ...... (d)}$$

Total protein (Bradford's assay). Bradford's reagent was used to extract soluble proteins (Jones *et al*., 1989). Extraction of soluble protein was done with ice-cold mortar and pestle in 5 mL of potassium phosphate buffer (0.1 M, pH=7) 1 g of leaves were homogenized. The homogenate extract is filtered with cheese cloth and glass wool and then the extract is placed in a refrigerator for cooling, and the extracts were centrifuged at 4000-12000 rpm for 10-20 min and then the supernatant was transferred into a test tube. About 5 mL extract was made with buffer. 0.2 mL of extract was taken for dilution and 4.8 mL of buffer and then 0.1 mL of the diluted extract was taken in a test tube, followed by the addition of 5 mL of Bradford assay reagent and shacked. 0.1 mL of the buffer are used as a blank and 5 mL of Bradford detection reagent was added. The optical density was measured at 595 nm in a spectrophotometer. First, with a reagent blank, then the optical density of the spectrophotometer was set to zero and the sample reading were recorded.

Total lipids. Total lipids were measured according to perversely described methods (Kruger, 2009; Van, 1985). According to the mentioned methods, 0.2 g of leaf sample was crushed in a 2:1 ratio of methanol and chloroform (v/v) and the tube was shaken systematically till 0.8 mL of 0.73% of chlorine was dissolved. The sodium solution was finished into a 2:1:8 ratio chloroform, sodium chloride and methanol. After shaking, the lower most layer was separated with the help of a separating funnel. After separating, 0.1 mL of H_2SO_4 was added and shaken. The samples were heated at 100 °C for 10 min. Then the sample was put in a refrigerator to cool and after cooling, 2.4 mL of Hualien red reagent was added. It the apprentice of pink colour, absorbance was measured at 490 nm.

IAA. Samples were centrifuged first at 10,000 rpm for 2 min and Salkowski reagent was added to the samples and kept all the samples in dark for 30 min. And the photo-spectrometer on 540 OD was analyzed by using (Saqib *et al*., 2020; Gilbert *et al*., 2018) method.

Catalase activity. Catalase activity was determined by using the methods of (Chandlee and Scandalios, 1984; Patra *et al*., 1978). According to these methods, 2.6 mL of 50 mM potassium phosphate buffer (pH 7.0), 200 µL of 5 mM H_2O_2 and 40 µL of the enzyme extract were added. After the dissociation of H_2O_2, the absorbance at 240 nm decreased and the enzymatic activity of the enzyme was determined as U = 1 protein (U = 1 mg/1H_2O_2 reduction).

Statistical analysis. The data were statistically analyzed by using one-way ANOVA. Different means were examined as statistically significant at $P<0.05$. Through SPSS the data was statistical analysis according to the instruction.

Results and Discussion

Effect of organic fertilizer on plant growth (germination assays). ***Plants' height and leaf size.*** Organic and inorganic fertilizers can affect plant growth, by increasing leaf width and increasing chlorophyll numbers. Fertilizers can also increase secondary metabolized by increasing the number of carotenoids, protein, total sugar and hormones as shown in (Fig 1). The different verity of beet roots, including RQ, DR and D2 were growing in the soil with organic and inorganic fertilizers. Plant height with urea had significantly increased all the verity as compared to control and the treatment of plants with salinity decreased plant height as compared to control. Application of NPK increases plants' height as compared to control. And the compost-treated plant's height was slightly greater as compared to the control, which was shown in (Fig. 1a). The leaf width had seen as high with treated with both organic and inorganic fertilizers, as compared to the control. Plants treated with urea and NPK, increase plants leaf size, while the ratio of compost for the growth and size of the leaf is slightly greater and treatment of plants with salinity decreases the plant's leaf width as compared to control which is clearly shown in (Fig. 1b).

Primary metabolites parameters of beetroots. ***Chlorophyll.*** After the experiment conducted in both the lab and field of *Beta vulgaris* L. cultivation, the organic and inorganic fertilizer treatment produced a higher number of chlorophyll in all the verities of selected plants than the untreated control (Fig. 1c). The number of chlorophyll was significantly increased after the treatment of urea, NPK and compost while sodium chloride can significantly decrease plant growth without being treated with fertilization. It is clear from (Fig. 1d). that chlorophyll content greatly varies with treatment as compared to control. When we treated plants with urea. So, there is a regular increase in chlorophyll in RQ, DR and D2 varieties as compared to the control. Application of NPK increases the plant's chlorophyll in RQ, DR and D2 variety as compared to control. Also, the compost-treated plant's chlorophyll increases regularly in RQ, DR, and D2 varieties as compared to the control. And treatment of plants with salinity shows a decrease in chlorophyll in RQ, DR and D2 varieties as compared to the control.

Carotenoids. After the application of both organic and inorganic fertilizers, increasing in the number of carotenoids has been seen at a high rate. Carotenoid content greatly changed with treatment as compared to control. Particularly, the RQ variant shows the highest increment concerning control after the treatment of urea. When we treated plants with urea. So, there is a regular increase in carotenoids in RQ, DR and D2 varieties as compared to the control. NPK fertilizer can enhance the number of carotenoids in beetroots at height levels. Because, NPK increases the plant's carotenoids in RQ, DR and D2 variety as compared to control. Also, the compost-treated plant's carotenoids increase irregularly in RQ, DR and D2 varieties as compared to the control. Treatment of plants with salinity shows a decrease in carotenoids in RQ, DR and D2, varieties as compared to the control.

Protein and sugar pigment contents. The total protein contents had been seen as high in all selected varieties (Fig. 1e). and the plant's total protein content increased after the addition of both organic and inorganic fertilizers at desired amounts. The highest amount of protein content has been reported in urea and NPK-containing soils. Moreover, fertilizer soils with urea increase the number of total proteins in RQ, DR and D2 variety as compared to control and fertilized soil with NPK had higher protein-containing plants than unfertilized soil. Also, the compost-treated plant's total proteins increase in RQ, DR and D2 variety as compared to the control, while plants treated with salinity show a decrease in total proteins in RQ, DR and D2 variety as compared to control.

The total sugar content (Fig. 1f). had seen in those plants which have been grown in the soil containing fertilizers. The highest sugar content has been reported in almost all verity of the beetroots which have been growing in the soil that contains urea, compost, and NPK. It is clear from (Fig. 1f). that carbohydrate content greatly varies with treatment as compared to control. When we treated plants with urea so there is an irregular and core increase in carbohydrates in RQ, DR and D2 varieties. Application of NPK increases the plant's carbohydrates in RQ, DR and D2 variety and the compost-treated plant's carbohydrates increase in RQ, DR and D2 variety and the plants treated with salinity show a decrease in carbohydrates in RQ, DR and D2 variety as compared to control.

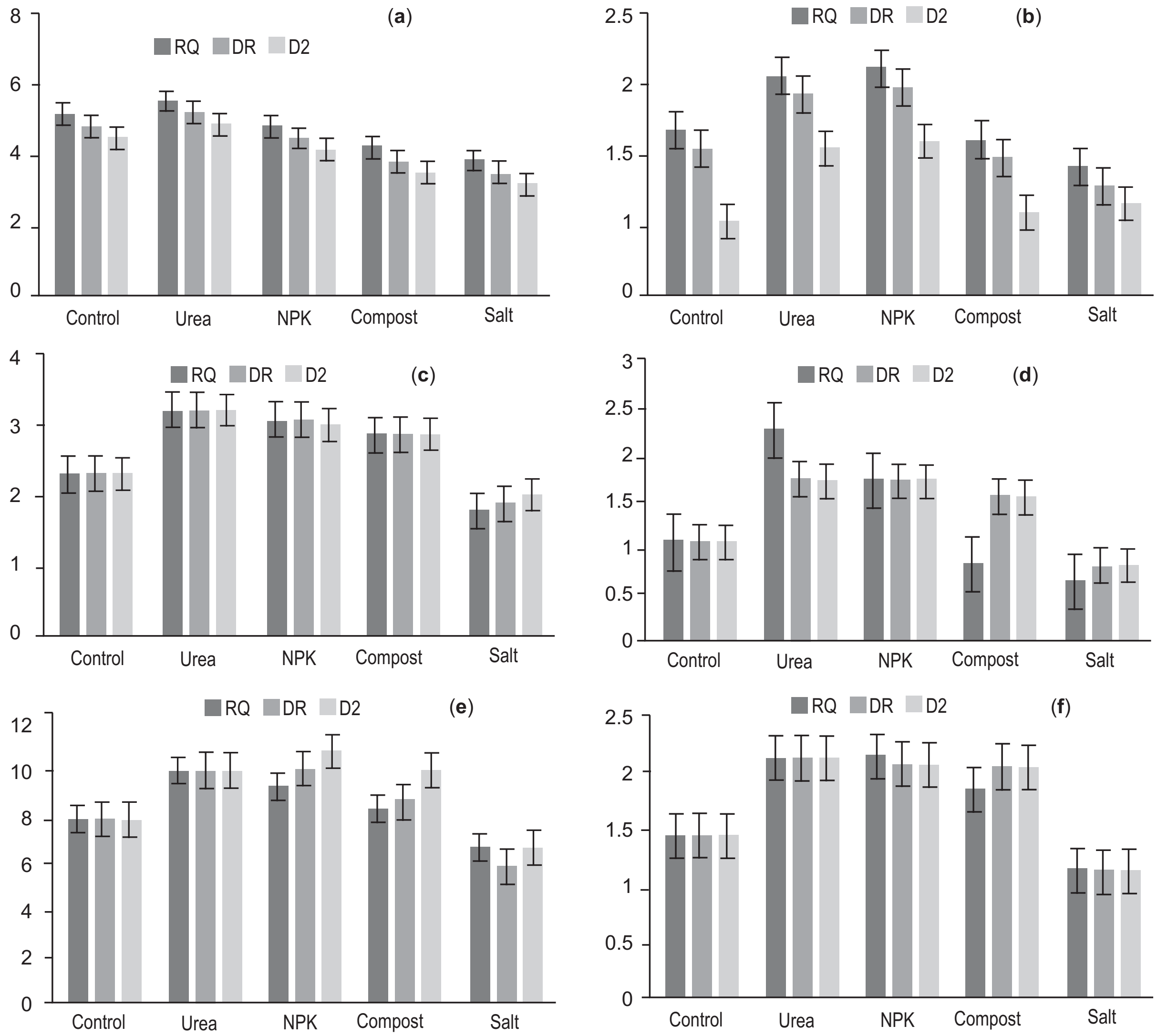

Fig. 1. The effects of urea, nitrogen, phosphorus, potassium, compost, and salt on beetroots during the field trial on **(a)** plant height, **(b)** leaf weight, **(c)**, chlorophyll **(d)** carotenoids, **(e)** total proteins and **(f)** Total sugar= RQ, ruby queen; DR= Detroit and D2= Detroit 2. The bars represent the mean ± SE of triplicate data (each replicate consisted of 4 seedlings).

Endogenous hormone. Effect of fertilizer on IAA. After treating *Beta vulgaris* with different organic and inorganic fertilizers the IAA rate increased in the below mentioned orders (Fig. 2a). The highest IAA abscission has been reported in the D2 variety after treating NPK fertilizer into the soil. The compost treatment was significantly lower than that of urea and NPK treatment while the effect of the same fertilizer is significantly higher than that of control and salt. When we treated plants with urea so there is a constant and major increase in IAA in RQ, DR and D2 varieties, while the application of NPK increases the plant's IAA in RQ, DR and D2 varieties. Also, the compost-treated plant's IAA increased in RQ, DR and D2 variety, and the treatment of plants with salinity shows a decrease in IAA in RQ, DR and D2 variety as compared to the control (Fig. 2a).

Effect of fertilizer on salicylic acid (SA). Salicylic acid plays an important role in photosynthesis, transpiration, transport and uptake of ions from the soil, endogenous signaling, plant growth and development, along with mediating plant defense against pathogens. After treating *Beta vulgaris* with fertilizers, Salicylic acid greatly differs with treatment as compared to other photochemical and phytohormones (Fig. 2b). When we treated plants with urea so there is an inconstant and slight decrease in salicylic acid in RQ, DR and D2 varieties. The application of NPK decreases the plant's SA in RQ, DR and D2 varieties, and the compost-treated plant's salicylic acid decreased in RQ, DR and D2 varieties as compared to the control. While the treatment of plants with salinity increases salicylic acid in RQ, DR and D2 varieties as compared to the control.

Effect of fertilizer on enzyme activity (catalase). After the application of urea, nitrogen, phosphorus, potassium, compost, and salt to beetroots during the field trial, the results suggest that all the fertilizer slightly enhances the enzymatic catalase effect of all selected varieties as compared to the control (Fig. 2c). Our result further suggested that DR can enhance the enzymatic activities of the catalase and should be considered the best crop for salinity soil. The effect fertilizer showed uniform growth and a slight increase in catalase in RQ, DR and D2 order. After the application of NPK highest increase had been reported in plant catalase in DR, variety as compared to control and treatment of plants with salinity shows a high increase in catalase in all RQ, DR and D2 varieties as compared to control.

Effect of fertilizer on total antioxidant. After the application of urea, nitrogen, phosphorus, potassium, compost, and salt to beetroots, our results suggest that all the fertilizer enhances the enzymatic catalase effect of RQ as compared to other varieties. While DR and D2 verities decrease the catalase effect as shown in (Fig 2d). When we treated plants with urea so there is an increase in total antioxidants in the RQ variety and a decrease in DR and D2 varieties, while the application of NPK increases the plant's total antioxidant potential in RQ and decreases in DR and D2 variety as compared to control. Also, the compost-treated plant's total antioxidant increase in RQ variety and decrease in DR and D2 variety as compared to the control. After the treatment of plants with salinity, increasing had been seen in the total antioxidant potential in all varieties as compared to the control.

The present research work in both (Fig. 1). and (Fig. 2). showed that the shoot length of the treated variety is greatly sensitive to urea, nitrogen phosphors potassium, compost, and salt. Shoot length was observed in the fieldwork in which the shoot length of urea-treated plants increases plants' height and treatment of plants with salinity decreases plants' height as compared to the control. Application of NPK increases plants' height and the compost-treated plant's height was slightly greater as compared to the control. Reduction in shoot length occurs when salt builds up excessively in the cell wall, subsequently changing the elasticity by limiting the metabolic activities of the cell wall. In addition, the cell wall hardens, secondary cells are produced more quickly and as a result, in cell growth, the efficiency of turgor pressure is reduced. The root elongation is stopped or slowed down by salt. Although a significant increase was noted in urea NPK and compost-treated plants as compared to the control. The effect of the salt on the parts of the twig is generally greater than the root studied.

Our results showed that the leaf width of the treated variety is greatly sensitive to urea, NPK, compost and salt. Leaf width was noticed in the fieldwork in which the plants treated with urea increased plant leaf width, treatment of plants with salinity decreased plants' leaf width and the application of NPK increases plants' leaf width, while the compost-treated plant's leaf width was slightly greater as compared to control. Reduction in shoot length occurs when salt accumulates excessively in the cell wall resulting in a limitation of metabolic activities and a change in the elasticity of the cell wall. In addition, the cell wall hardens, secondary cells are produced more quickly and as a result, in cell growth, the efficiency of turgor pressure is reduced. Root elongation is inhibited or slowed down by microbes.

Chlorophylls are crucial pigments of photosynthesis that generate light energy and convert it into chemical energy (Chen *et al*., 2010). The present results show that the Chlorophyll pigment is greatly sensitive to different treatments. When we treated plants treated with urea so there is a regular increase in chlorophyll in RQ, DR and D2 varieties as compared to the control. Application of NPK increases the plant's chlorophyll in RQ, DR and D2 variety as compared to control. Also, the compost-treated plant's chlorophyll increases regularly in RQ, DR and D2 variety and treatment of plants with salinity shows a decrease in chlorophyll in RQ, DR and D2 variety as compared to the control. This lack of chlorophyll may be due to the weakening of the membranes caused by salt stress.

Carotenoids are mainly C40 terpenoids, a class of hydrocarbons that participate in various biological processes in a plant, such as photosynthesis, photo-

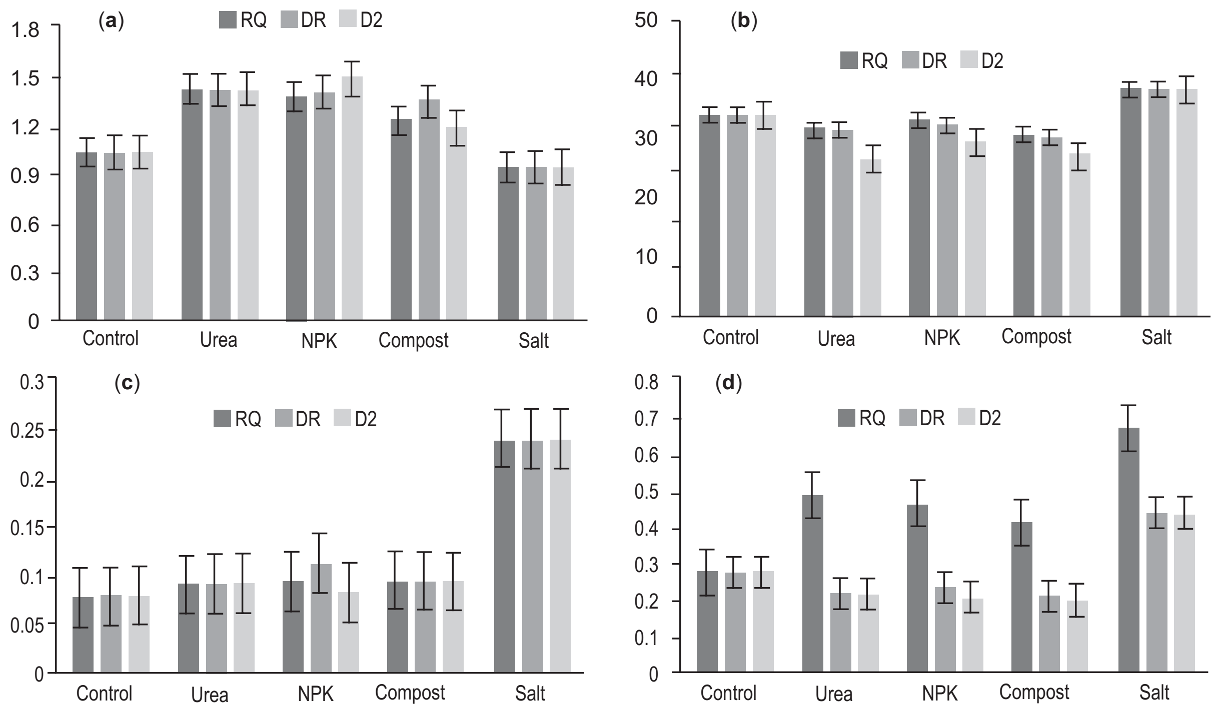

Fig. 2. The effects of urea, nitrogen, phosphorus, potassium, compost, and salt on beetroots during the field trial on **(a)** IAA, **(b)** salicylic acid, **(c),** catalase, **(d)** total antioxidant, RQ= ruby queen; DR= Detroit and D2= Detroit 2. The bars represent the mean ± SE of triplicate data (each replicate consisted of 4 seedlings).

morphogenesis and photo-protection (Nisar *et al*., 2015). The present result showed that the carotenoid content is sensitive to different treatments. When we treated plants with urea so there is a regular increase in carotenoids in RQ, DR and D2, while with the application of NPK increases the plant's carotenoids in RQ, DR and D2 variety as compared to the control. Compost treated plant's increase carotenoids irregularly in RQ, DR and D2 variety as compared to control. This increase in the carotenoid content is due to the activation of their biosynthetic pathway. Therefore, the accumulation of carotenoids caused by salt treatment can result from the activation of the Mevalonic Acid pathway to produce ABA.

Carbohydrates are the major organic solutes associated with osmotic adjustment (Lacerda *et al*., 2001). Current results showed that carbohydrates are critically sensitive to different treatments. Carbohydrates in all treatments increased as compared to control when we treated plants with urea so there is an irregular and core increase in carbohydrates in RQ, DR and D2 varieties. Application of NPK increases plant's carbohydrates in RQ, DR and D2 variety as compared to control. Also, the compost-treated plant's carbohydrates increase in RQ, DR and D2 variety as compared to the control. Plants treated with salinity show a decrease in carbohydrates in RQ, DR and D2 types when compared to the control. Increase in carbohydrates may be due to an increased sugar storage capacity or increase in the radical translocation of sugar as a result of sprout stress. Photosynthesis is the chief source of the accumulation of organic solutes underwater pressure. Reduced photosynthesis might stand due to the destruction of the response in the mesophyll cells to the high sugar concentration (Negin *et al*., 2019). (Jelinek and Kolusheva, 2004) stated that changes in carbohydrates are essential due to their interactions with physiological progressions such as translation, photosynthesis and respiration. Under the influence of salt, the accumulation of proteins in plants can play a role in regulating osmosis and generate a form of accumulation of stored nitrogen at the end of the stress (Ekinci and Turan, 2021).

Current results showed that the proteins are sensitive to different treatments. When we treated plants with urea so there is a regular increase in total proteins in RQ, DR and D2 varieties as compared to the control. Application of NPK increases the plant's total proteins in RQ, DR and D2 variety as compared to control. The compost-treated plant's total proteins increased in RQ, DR and D2 variety as compared to the control. And treatment of plants with salinity shows a decrease in total proteins in RQ, DR and D2 varieties as compared to the control. This increase may be due to the correct synthesis of a structural protein that is involved in the modification of the cell wall (Singh *et al*., 1989).

In regulating plant growth, IAA plays an important role as it controls apical dominance, cell elongation and vascular tissue development (Wang *et al*., 2001). Current results showed that the IAA is highly sensitive to different treatments. We treated plants with urea so there is a constant and major increase in IAA in RQ, DR and D2 variety as compared to control. Application of NPK increases plant's IAA in RQ, DR and D2 variety as compared to control. Also, the compost-treated plant's IAA increased in RQ, DR and D2 variety as compared to the control. Plants treated with salinity shows a decrease in IAA in RQ, DR and D2 varieties as compared to the control. Furthermore, in response to abiotic stress, the generation of ROS may also affect the auxin response. IAA plays a major role in modifiable procedures connected to plant development such as apical dominance, vascular tissue development, and cell elongation (Wang *et al*., 2001).

Salicylic acid is known to be an endogenous signaling molecule, involved primarily in environmental stress tolerance in plants. Salicylic acid (SA) and Jasmonic acid (JA) play central roles in mediating stress responses in plants. Salicylic acid (SA) is a phytohormone that plays a central role in the defense of plants and the establishment of acquired systemic resistances (Maruri-López *et al*., 2019; Bari and Jones, 2009). Current results showed that salicylic acid is highly sensitive to different treatments. When we treated plants with urea so there is an inconstant and slight decrease in salicylic acid in RQ, DR and D2 varieties as compared to the control. Application of NPK decreases the plant's salicylic acid in RQ, DR and D2 variety as compared to control. Also, the compost-treated plant's salicylic acid decreased in RQ, DR and D2 variety as compared to the control. And treatment of plants with salinity shows an increase in salicylic acid in RQ, DR, and D2 varieties as compared to the control. Plants treated with salinity show, increase in salicylic acid in RQ, DR and D2 varieties as compared to the control.

The level of antioxidant response depends on the intensity of stress, metabolic state, growth, and plant species (Oliveira *et al*., 2012). The present study investigates that total antioxidants are critically sensitive to different treatments. When we treated plants with urea so there is an increase in total antioxidants in the RQ variety and a decrease in DR and D2 variety as compared to the control. Application of NPK increases the plant's total antioxidant in the RQ variety and decreases in DR and D2 variety as compared to the control. Also, the compost-treated plant's total antioxidant increase in RQ variety and decrease in DR and D2 variety as compared to the control. Treatment of plants with salinity shows an increase in total antioxidants in RQ, DR and D2 varieties as compared to the control. Phenolic compounds show antioxidant activity by inactivating lipid free radicals or by inhibiting the decay of H_2O_2 into free radicals (Fernandez-Panchon *et al*., 2008). Due to their radical scavenging abilities, these antioxidant abilities may be directly related to the number of phenolic compounds (Karthishwaran *et al*., 2018).

Catalase, an antioxidant enzyme highly active in the prevention of oxidative stress damage, is involved in the degradation of hydrogen peroxide into oxygen and water (Mittler, 2002). Present results showed that catalase is sensitive to different treatments. When we treated plants with urea so there is a uniform and slight increase in catalase in RQ, DR and D2 varieties as compared to the control. Application of NPK increases plant catalase in RQ, DR and D2 variety as compared to control. Also, the compost-treated plant's catalase increased in RQ, DR and D2 variety as compared to the control. Plants with salt shows a high increase in catalase in RQ, DR and D2 variety as compared to control. CAT is known to have a multi-gene family responsible for encoding important plant proteins. These important proteins have an important significant role in the localization, regulation and expression of stress-receptive genes in cells exposed to various environmental stresses (Su *et al*., 2014). The expression of various plant catalase genes is temporally and spatially regulated and responds to evolutionary and environmental oxidative stimuli (Purev *et al*., 2010).

Conclusion

In the current study different treatments i.e. Urea, NPK, compost and salt (NaCl) was applied to different varieties of *Beta vulgaris* and different parameters were measured. Among all of them, the urea treated plants show maximum growth. The growth in salt-treated plants was reduced. In the NPK and compost-treated plants, shows more growth as compared to compost. The metabolic content such as IAA, chlorophyll and phenolic content, etc. shows maximum results in Urea, NPK and compost treated plants as compared to salt-treated plants.

Our finding show that using organic and inorganic fertiliser considerably increases plant height and leaf weight under stress conditions. Moreover, the metabolic content, such as total protein, sugar, carotenoids and chlorophyll numbers of *B. vulgaris* can be improved by the application of these fertilized under stress conditions.

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Conflict of Interest. The authors declare that they have no conflict of interest.

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