Plant Archives Vol. 19, Supplement 2, 2019 pp.2373-2385 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

RESPONSE OF POTASSIUM SULPHATE AND BORIC ACID TO TWO VARIETIES OF BEET (*BETA VULGARIS* L.) ON ANATOMICAL CHARACTERISTICS

Zainab Hasan Thajeel and Jamal Ahmed Abbass
Department of Horticulture and Landscape Design, Faculty of Agriculture, University of Kufa. Republic of Iraq

Abstract

An field experiments were conducted at AL-Najef Governorate, Iraq during 2016/2017 and 2018/2019 seasons to study the effect of fertilization with potassium sulphate and spraying boric acid on anatomical characteristics of two varieties of beet (local and foreign newly introduced to Iraq). Potassium sulphate (K_2O, 50%) added in three level i.e. (0,100, 150) kg.Ha^{-1}, boric acid (B, 17%) were sprayed in a three concentration *i.e.* (0,5, 10) g.L^{-1} sprayed in two time, Experiments were adopted in a Randomized Complete Block Design (R.C.B.D) in Split-Split plots Design for two seasons and three factors with three replicates

The results revealed that the interaction treatment between fertilization beet with potassium sulphate in a level 150 kg.Ha^{-1} and spraying boric acid at a concentration of 10g.L^{-1} (K2B2), and the interaction treatment between fertilization beet with potassium sulphate in a level 100kg.Ha^{-1} and spraying boric acid at a concentration 5 g.L^{-1}(K1B1) showed the highest values of most anatomical studied characters; as well as in both studied growing seasons as compared with using each control treatment. However, treatments B2K2, B1K1 showed that the higher mean number of vascular bundles, growth ring thickness, diameter, number of growth rings in secondary growth and parenchyma thickness. Treatment K0B2 showed that the highest vessel diameter in secondary growth and peripheral epidermis thickness. treatment K2B0 showed that the highest measurements of parenchyma. Interestingly that anatomical characters of root, such as root diameter, number of vessels/bundle in root were increased with the interaction treatment between fertilization beet with potassium sulphate in a level 150kg.Ha^{-1} and spraying boric acid at a concentration of 10g.L^{-1}. It can be concluded that fertilization beet with potassium sulphate and spraying plant with boric acid led to maximize beet productivity . This shows the synergism effect of both potassium and boron in an improvement plant growth.

Keywords: Beet. Fertilization. Spraying. Anatomical characteristics.

Introduction

Beet (*Beta vulgaris L.*) belongs to chenopodiaceae family. It is a biennial plant (Matlob *et al*., 1989) Fertilizers play an important role in increasing root Beet production. One of the main macronutrients present in inorganic fertilizers was potassium which influence vegetative and reproductive phase of plant growth (Attarda *et al.*, 2012), its plays an important role in enzyme activation, charge balance and osmoregulation in plants. In beet potassium plays a significant role in biosynthesis and transfer of sucrose to storage roots (Cakmak, 2005). Also Boron and potassium fertilizer improvement yield and quality of Beet. Abdelaal *et al.* (2015) reported that application of potassium at level of 48 kg K_2O.fed^{-1} and foliar spraying with some microelements significantly increased root diameter and root fresh weight, root and sugar yields as well as sucrose percentage. El-Nagdy *et al.* (2010) mentioned that application of mineral fertilizers potassium and boron led to significant increase in diameter of the main stem, thickness of epidermis, phylum tissue, secondary xylem, secondary phloem and pith diameter of flax plants. Agamy *et. al*.[2013] mentioned that mineral-fertilizers increased the thickness of growth rings of beet roots and average diameter of xylem vessels.

Therefore the aim of this research was to study the effect of potassium sulphate and boric acid on anatomical structure of two varieties of root beet to improvement beet production quality.

Materials and Methods

An field experiments were carried out in Najef Governorate, Iraq during 2016/2017 and 2018/2019 seasons, to study the effect of fertilization with potassium sulphate and spraying boric acid on anatomical structure of two varieties of beet. Beet seeds were sown at 10^{th} of August in the first and second season. Four seed per hill were sown, plants were thinned to one plant per hill when the plant height 5–7 cm (Matlob *et al*., 1989).

An factorial experiments were adopted in a Randomized Complete Block Design (R.C.B.D) in Split-Split plots Design for two seasons and three factors with three replicates, First two beet varieties (local and foreign newly introduced to Iraq). Second fertilization plants with three levels of potassium sulphate produced by an Indian company (K_2O, 50%) at three level *i.e.* (0,100 and150) kg.Ha^{-1} Symbolizes them (K0, K1 and K2) (Abo El-Nasr and Ibrahim, 2015) which put it in the Main plot, added in two time. First after three weeks from planting, Second after three weeks from the first. Third spraying three concentration of boric acid produced by an Indian (17% B) *i.e*. (0, 5 and 10) g.L^{-1} Symbolizes them (B0, B1 and B2) (Gehan *et al.*, 2013) put in Sub-plot, which is sprayed in two time, first after formation 4-5 true leaves in plant, second after 26 weeks from planting (Armin and Asgharipour, 2011). Means were compared by least significant difference (LSD) at the probability level of 0.05 (Al-Rawi and Khalaf-Alla, 2000). Each experimental unit included 5 ridges, 60 cm apart and 3.5m length, resulted an area of 10.5m2. The area of each plot was 12 m^2.

Plants were kept free from weeds, which were manually controlled by hand hoeing at three times. The common agricultural practices for growing beet according to the recommendations of the Ministry of Agriculture were followed. Surface soil (0-30 cm depth) was sampled before land preparation as representative sample and analyzed according to procedures suggested by (Black, 1965) as shown in Table (1).

Table 1 : Chemical and physical properties of the experimental soil

Soil texture (Salty sand)	**Soil particles (%)**	Quantity
	Clay	88
	Salt	204
	Sand	708
Chemical properties	**Values**	**Unit**
Chemical analysis		
$CaCO_3$ (%)	14.30	14.30
Organic matter (%)	1.5	1.5
Available N (ppm)	0.672	0.672
Available P (ppm)	0.684	0.684
Available K (ppm)	5.3	5.3
Ph	7.65	7.65

At maturity (age of 120 days), the three middle rows of each plot were harvested the roots, five plants selected randomly of each plot. The plants were separated into shoot and root and the following anatomical characteristics were determined:

For anatomical characteristics, specimens from selected samples were taken during the first and second season from the root at the age of 8 weeks for plate (A), 10 weeks for plate (B) and 12 weeks for plate (C) from sowing. Samples were killed and fixed for at least 48 hours. In formalin acetic acid alcohol (F.A.A.) solution [5 ml glacial acetic acid, 10 ml formalin and 85 ml ethyl alcohol 70%]. Samples were washed in 50% ethyl alcohol and dehydrated in a normal butyl alcohol series. The specimens were impeded in paraffin wax (56-58°C). Transverse sections (12-15 microns) thick were done with rotary microtome model 820. Paraffin sections were fixed on the slides with albumin, stained with safranin and light green and mounting in Canada balsam (Guda *et al*., 2013). Slides were examined microscopically and photomicrography.

The characteristics were studied was: peripheral epidermis, growth rings in the secondary growth and parenchyma and cork tissue.

Results and Discussion

Root anatomy

Anatomical structure of beet root in cross a sections of plates (1, 2, 3, 4, 5, 6, 7, 8 and 9), and data in Table 1and 2 shows that a secondary growth of beet root, such as the rest of Dicot plants, which are circular, secondary growth, and characterized by tissue systems. The Periderm connective tissue consists of Cork, Phellogen and Phelloderm. Followed by the Vascular Cylinder, which consists of several concentric growth rings. Their number depends on secondary growth. Each ring consists of xylem vessels followed by vascular cambium and then the phloem, interspersed with vascular radiation, which reaches the root center almost, showing vascular vascularity, between growth rings.

Results showed that the treatment K2B2 and K1B1 increased root diameter, number of growth rings, and average periderms thickness of beet roots compared treatment K2B0 and K0B2 and K0BO (Fig 1. 9). This results may be due to the important role of the synergy effect between potassium and boron element in enhancement root growth, increase cell division and elongation (Guda et al., 2018). These results were supported by similar results which obtained by (El-Nagdy *et al*., 2010) and (Agamy *et al*., 2013).

Table 1 : Effect of table beet, boron and potassium cultivars on peripheral epidermal thickness for the first two seasons (2017-2018)

Treatments	**Boron / Potassium**	**B0**	**B1**	**B2**	**V* K**	**Average V**
V1	K0	48.47	61.60	70.53	60.20	62.88
	K1	61.67	62.60	74.57	66.28	
	K2	48.97	60.87	76.67	62.17	
V2	K0	51.43	61.17	73.53	62.04	64.32
	K1	54.73	63.70	74.00	64.14	
	K2	58.20	63.23	78.90	66.78	
Average V					4.655	LSD V =
LSD (V * K) = 3.621			LSD (V * K * B) = 4.441			

Varieties	**B0**	**B1**	**B2**	**Average V**
V 1	53.03	61.69	73.92	62.88
V 2	54.79	62.70	75.48	64.32
Average B	53.91	62.19	74.70	
LSD (V) = 4.655	LSD (B) = 1.736		LSD (V * B) = 3.532	

Potassium	**B0**	**B1**	**B2**	**Average K**
K0	49.95	61.38	72.03	61.12
K1	58.20	63.15	74.28	65.21
K2	53.58	62.05	77.78	64.47
Average B	53.91	62.19	74.70	
LSD (K) = 1.431		LSD (K * B) = 2.734		

Table 2 : Effect of table beet, boron and potassium cultivars on the number of vessels in the secondary growth of the two seasons of the first season (2017 - 2018)

Treatments	Boron / Potassium	B0	B1	B2	V* K	Average V
V1	K0	2.000	2.333	3.000	2.444	2.704
	K1	2.000	3.667	2.000	2.556	
	K2	2.000	2.667	4.667	3.111	
V2	K0	2.000	3.000	3.333	2.778	2.889
	K1	2.000	4.000	2.000	2.667	
	K2	2.000	3.000	4.667	3.222	
Average V						LSD V = 0.3187
LSD (V * K) = 0.3208			LSD (V * K * B) = 0.5533			

Varieties	B0	B1	B2	Average V
V 1	2.000	2.889	3.222	2.704
V 2	2.000	3.333	3.333	2.889
Average B	2.000	3.111	3.278	
LSD (V) = 0.3187	LSD (B) = 0.2387		LSD (V * B) = 0.3194	

Potassium	B0	B1	B2	Average K
K0	2.000	2.667	3.167	2.611
K1	2.000	3.833	2.000	2.611
K2	2.000	2.833	4.667	3.167
Average B	2.000	3.111	3.278	
LSD (K) = 0.2453		LSD (K * B) = 0.3976		

With respect to the effect of boron fertilizer rates on nutrients uptake (Guda *et al*., 2018) and (Clocte *et al*., 2009) mentioned that foliar fertilization has been increased in nutrition of field crops especially in calcareous soil where the loss through fixation of applied fertilizers seemed higher therefore, foliar application of the essential elements seemed to be an important supplementary method to provide beet with some micronutrients such as boron which is the nutrients that are needed as fertilizers. Also in this connection, it was reported that micronutrients application increase both the efficiency of the roots in absorbing nutrients from the soil and the root size, i.e. nutrient absorption surface through stimulating plant metabolism (Guda *et al*., 2016).

Plate (1) showing that the plant contains two growth rings and compared to the rest plate , this treatment showed the lowest average number of vascular bundle ,the thickness of growth rings, diameter of growth rings in secondary growth , diameter of vessels in secondary growth, peripheral epidermis thickness and thickness of parenchyma.

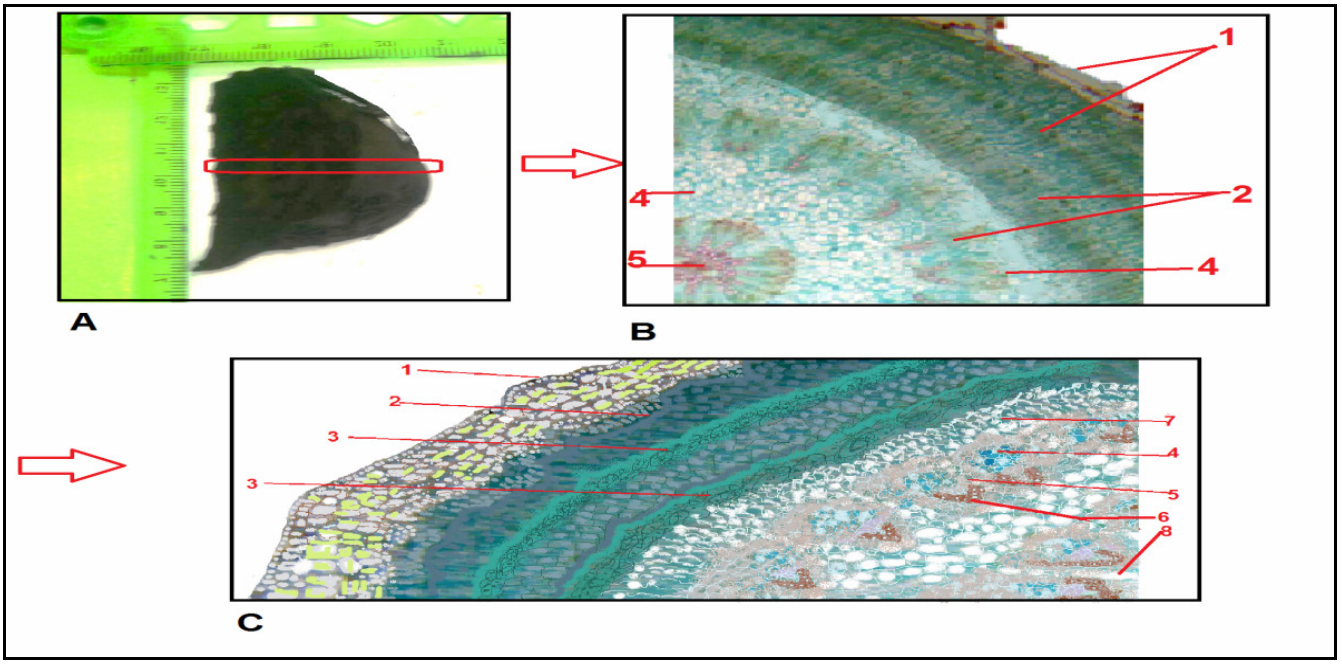

Plate (1) : (A)Showing beet plant root as a general shape, (B) **A cross section of the root** treatment of KOBO under 10X magnification showing 1 = peripheral epidermis, 2 = growth rings, 3 = parenchyma tissue, 4 = vascular bundle, 5 = central vascular bundle, (C) Showing 1 = epidermis, 2 = phylogen, 3 = cork, 4 = phylem tissue, 5 = vascular cambium , 6 = xylem tissue, 7 = parenchyma tissue, and 8 = central vascular bundle.

Note that the plant contains two growth rings and compared to the rest plates, this treatment showed a relatively midle measurement of the diameter of vessels in secondary growth and peripheral epidermis thickness, the mean number of vascular bundle and the thickness of growth rings and diameter of growth rings and the number of growth ring in secondary growth The thickness of the parenchymais relatively samll(Plate, 2).

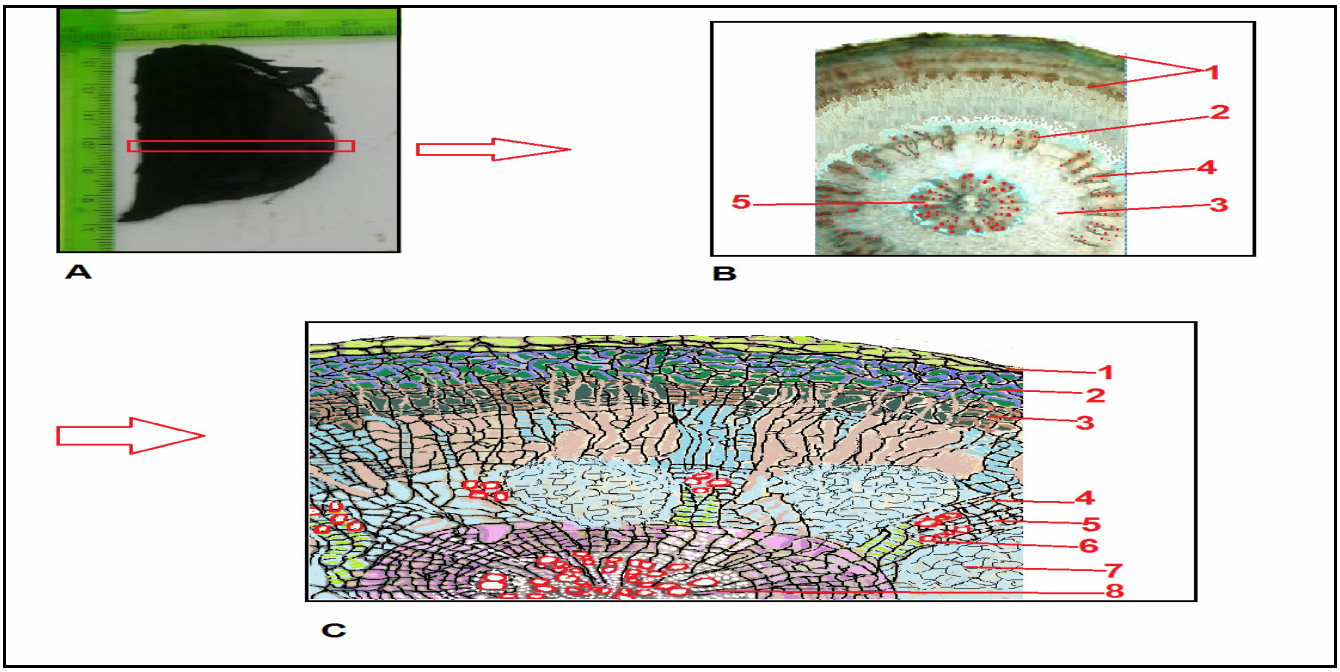

Plate 2 : (A)Showing beet plant root as a general shape of root, (B) **A cross section of the root** treatment of KOB1 under 10X magnification, showing 1 = peripheral epidermis, 2 = growth rings, 3 = **parenchyma** tissue, 4 = vascular bundles, **5 = central vascular bundle,** (C) Showing 1 = epidermis, 2 = chromium, 3 = cork, 4 = **phylem tissue**, 5 = **vascular cambium**, 6 = **xylem tissue**, 7 = **parenchyma** tissue, and 8 = central vascular bundle**.**

Plate (3) showing that the plant contains two growth rings and compared with the rest plate , this treatment showed the highest measurement of the diameter of vessels in secondary growth, peripheral epidermis thickness, the mean number of vascular bundle, the thickness of growth rings , diameter of growth rings ,the number of arches in secondary growth and thickness of parenchyma It is relatively small.

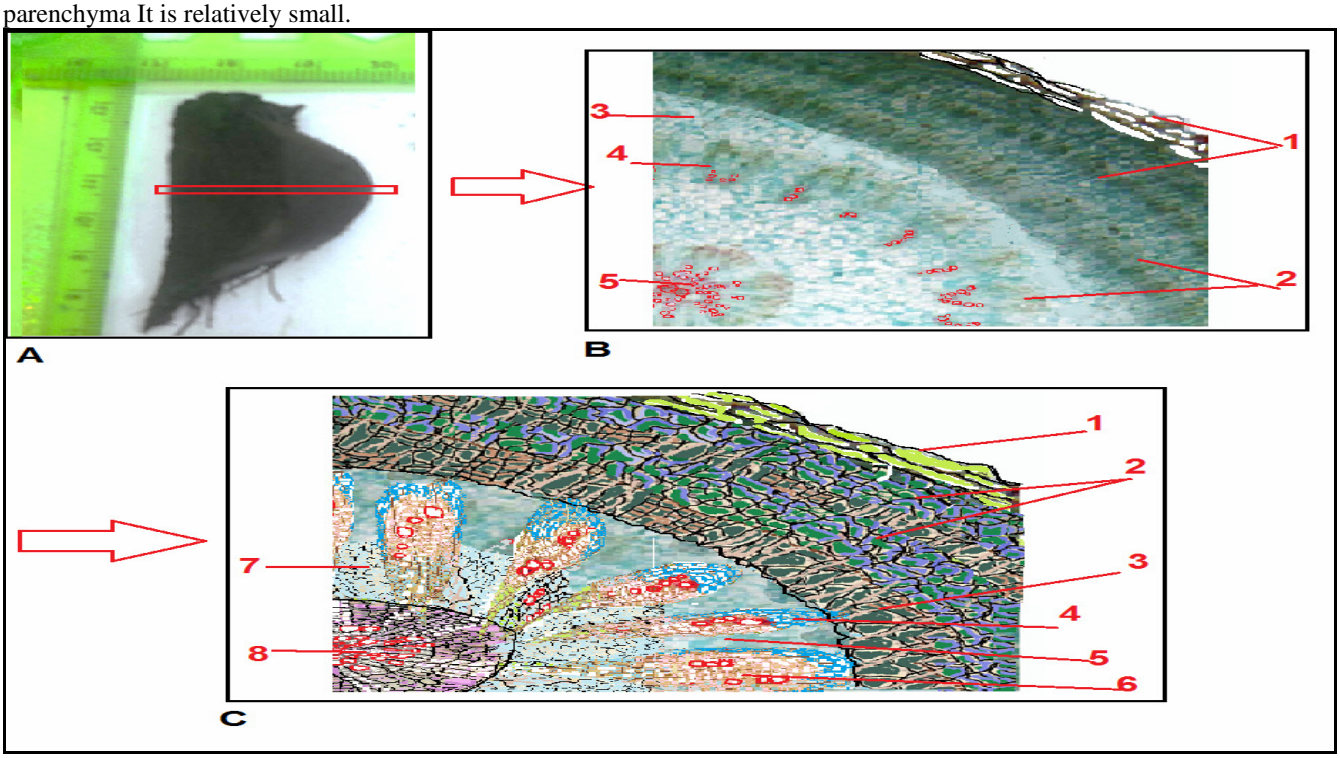

Plate 3 : (A)Showing sugar beet plant root as a gerenl shap, **(B) A cross section of the root** treatment of K0B2 under 10X magnification showing 1 = peripheral epidermis, 2 = growth rings, 3 = **parenchyma** tissue, 4 = vascular bundle, **5 = central vascular bundle,** (C) Showing 1 = epidermis, 2 = chromium, 3 = cork, 4 = **phylem tissue** , 5 = **vascular cambium**, 6 = **xylem tissue** , 7 = **parenchyma** tissue, and 8 = central vascular bundle**.**

Note that compared to the rest plates, this treatment showed the highest mean number of vascular bundles, the thickness of the growth rings, the diameter of the growth rings, the number of ring in the secondary growth and the thickness of the parenchyma. The diameter of the vessels in the secondary growth and the thickness of the peripheral epidermis is relatively small (Plate 4).

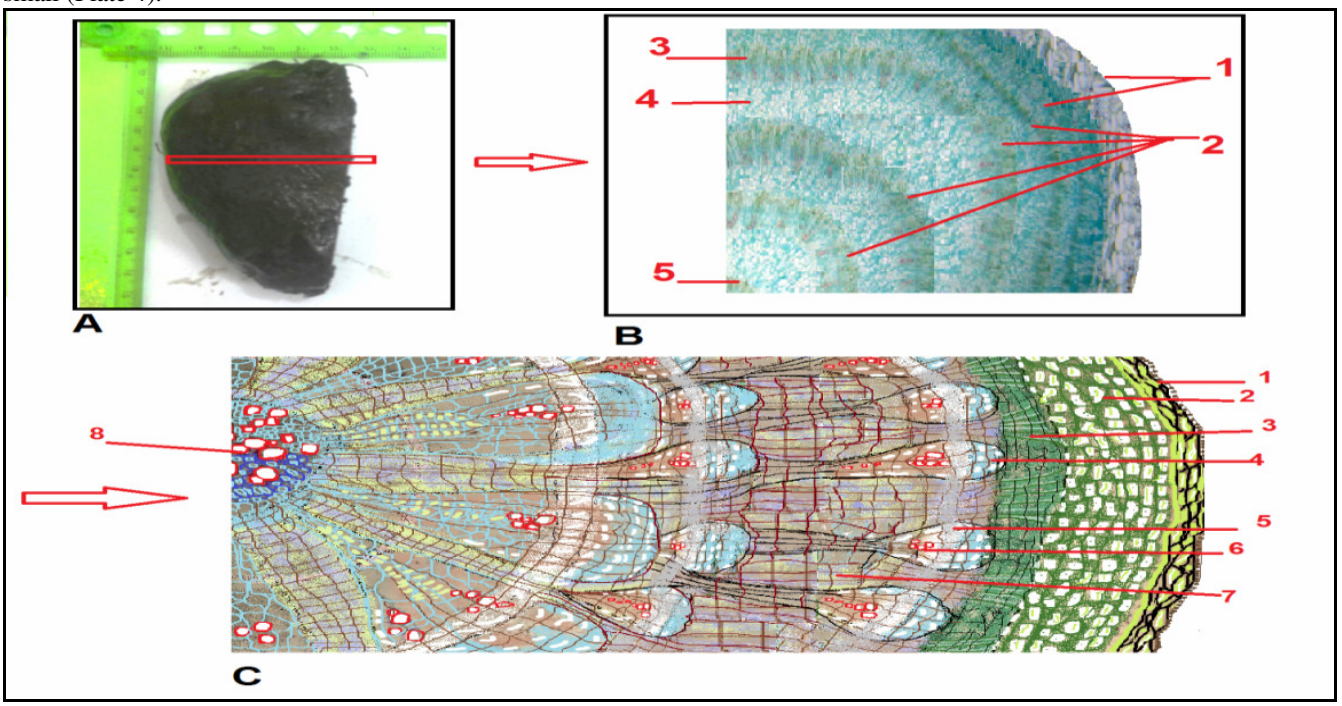

Plate 4 : (A) Showing beet plant as a general shape of root, (B) **A cross section of the root** treatment of K2B2 under 10X magnification showing 1 = peripheral epidermis, 2 = growth rings, 3 = **parenchyma** tissue, 4 = vascular bundle, (C) Showing 1 = epidermis, 2 = chromium, 3 = cork, 4 = phylem tissue, 5 = vascular cambium, 6 = xylem tissue, 7 = **parenchyma** tissue, and 8 = central vascular bundle**.**

Note that plate (5) contains two growth rings and compared with the rest plate, this treatment showed the least measurement of the diameter of vessels in secondary growth, peripheral epidermis thickness, the mean number of vascular bundle, the thickness of growth rings, diameter of growth rings, the number of arches in secondary growth and thickness of parenchyma, It is relatively midle.

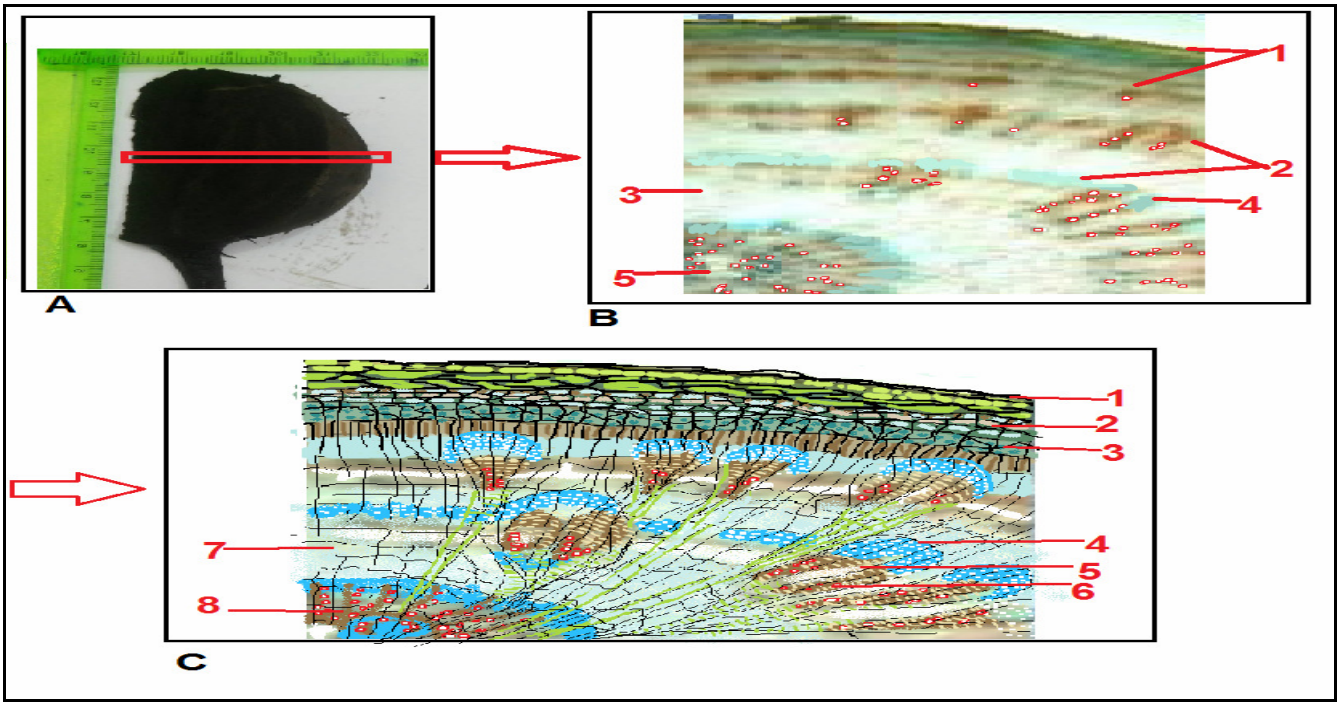

Plate 5 : Sowhing beet plant root as a general shape of root, (B) **A cross section of the root** treatment of K2B0 under 10X magnification showing 1 = peripheral epidermis, 2 = growth rings, 3 = Bernacamic tissue, 4 = vascular bundle, (C) Showing 1 = epidermis, 2 = chromium, 3 = cork, 4 = phylem tissue, 5 = vascular cambium, 6 = xylem tissue, 7 = **parenchyma** tissue, and 8 = central vascular bundle**.**

Plate(6) showing that the plant contains three growth rings and compared to the rest plates showed relatively high measurements in the average number of vascular bundle, the thickness of growth rings, diameter of growth rings in secondary growth, thickness of parenchyma, the diameter of vessels in secondary growth and epidermis Peripheral thickness, It is relatively midle.

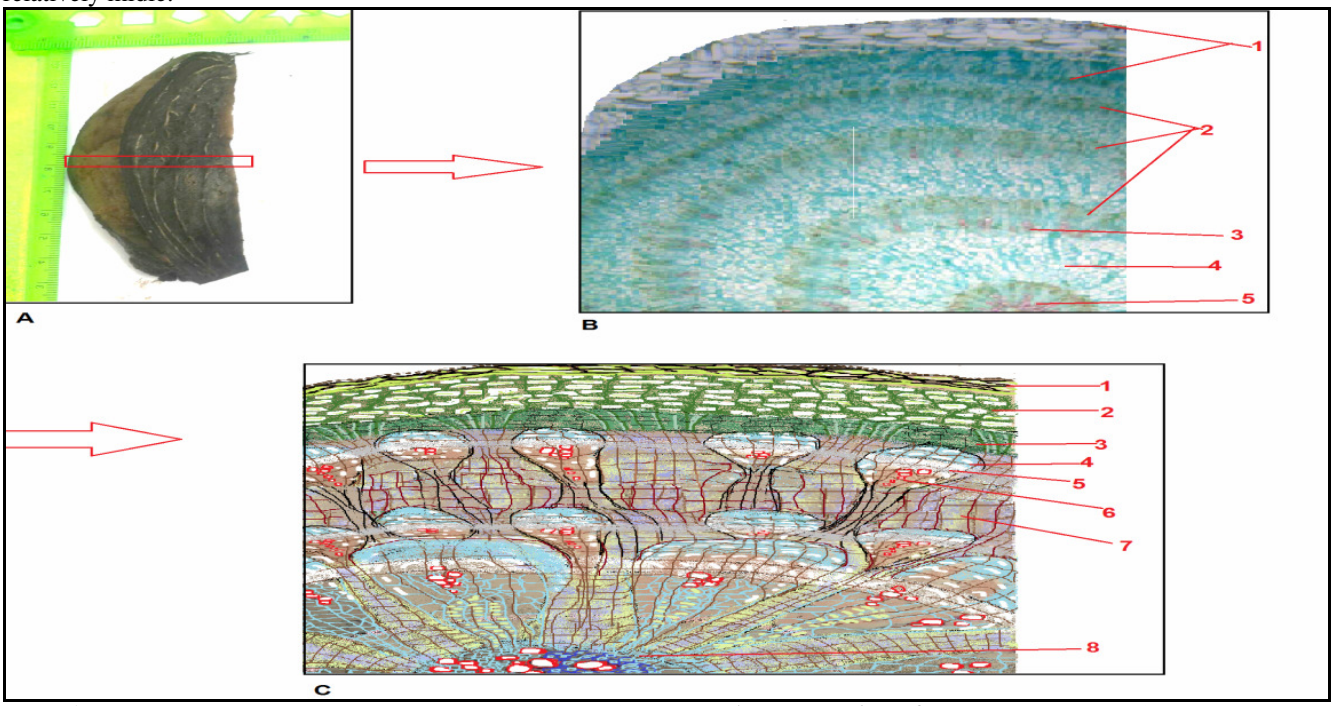

Plate 6 : (A) Showing beet plant root as a general shape of root, (B) **A cross section of the root** treatment of B1K2 under 10X magnification, showing 1 = peripheral epidermis, 2 = growth rings, 3 = Bernacamic tissue, 4 = vascular bundle, (C) Showing 1 = epidermis, 2 = corpus laminar, 3 = cork, 4 = phylem tissue, 5 = vascular cambium, 6 = xylem tissue, 7 = **parenchyma** tissue, and 8 = central vascular bundle.

Plate (7) show two growth rings compared to the rest plates, this treatment showed relatively moderate measurements of the vessel diameter in secondary growth, epidermis thickness, the average number of vascular bundles, the thickness and diameter of growth rings and the number of vessels in the secondary growth and thickness of parenchyma.

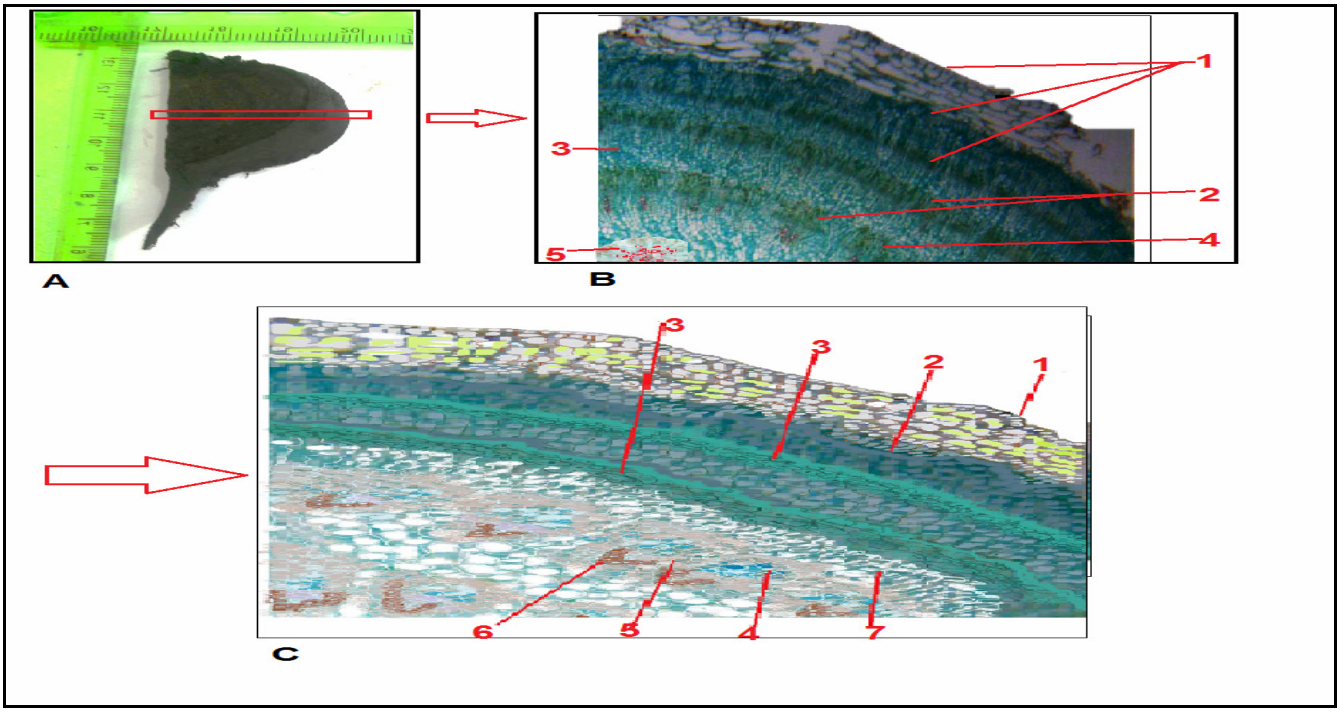

Plate 7 : (A)Showing beet plant root as a general shape of root and (B) **A cross section of the root** treatment of K1B2 under 10X magnification showing 1 = peripheral epidermis, 2 = growth rings, 3 = Bernacamic tissue, 4 = vascular bundle, 5 = The diagram shows an illustration, (C) Showing that 1 = epidermis, 2 = chromium, 3 = cork, 4 = phylem tissue, 5 = cobium, 6 = xylem tissue, 7 = **parenchyma** tissue, and 8 = central vascular bundle.

Note that the plant has four growth rings. Compared with the **rest plates**, this treatment showed relatively moderate measurements of the diameter of vessels in secondary growth, peripheral epidermis thickness, high measurements in the average number of vascular bundles, thickness of growth rings, diameter of growth rings and number of vessel in secondary growth and **parenchyma** thickness (Plate, 8). هذا الكلام

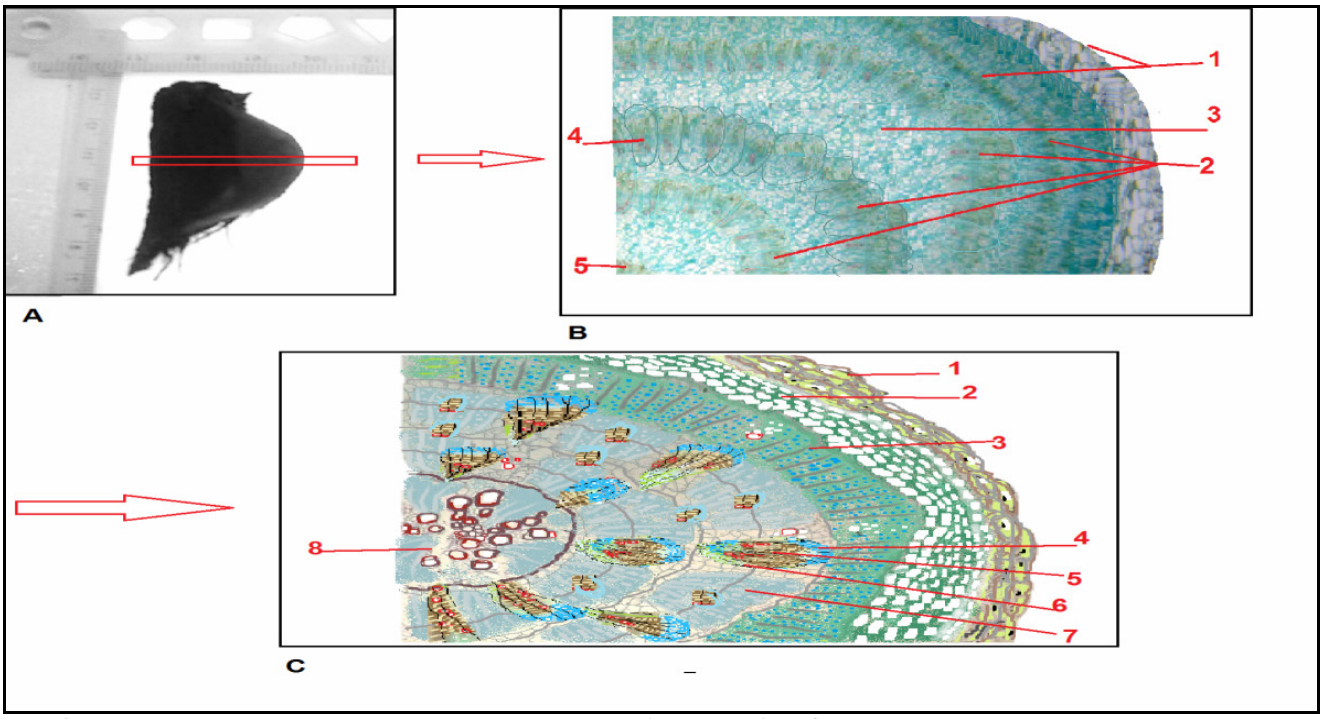

Plate 8 : (A)Showing beet plant root as a general shape of root (B) **A cross section of the root** treatment of K1B1 under 10X magnification, showing 1 = peripheral epidermis, 2 = growth rings, 3 = **parenchyma** tissue, 4 = vascular bundle, (C) Showing 1 = epidermis, 2 = chromium, 3 = cork, 4 = phylem tissue, 5 = vascular cambium, 6 = xylem tissue, 7 = **parenchyma** tissue, and 8 = central vascular bundle**.**

Note that the plant has four growth rings. Compared with the **rest plates**, this treatment showed relatively moderate measurements of the diameter of vessels in secondary growth , peripheral epidermis thickness , high measurements in the average number of vascular bundles, thickness of growth rings, diameter of growth rings and number of vessel in secondary growth and **parenchyma** thickness.

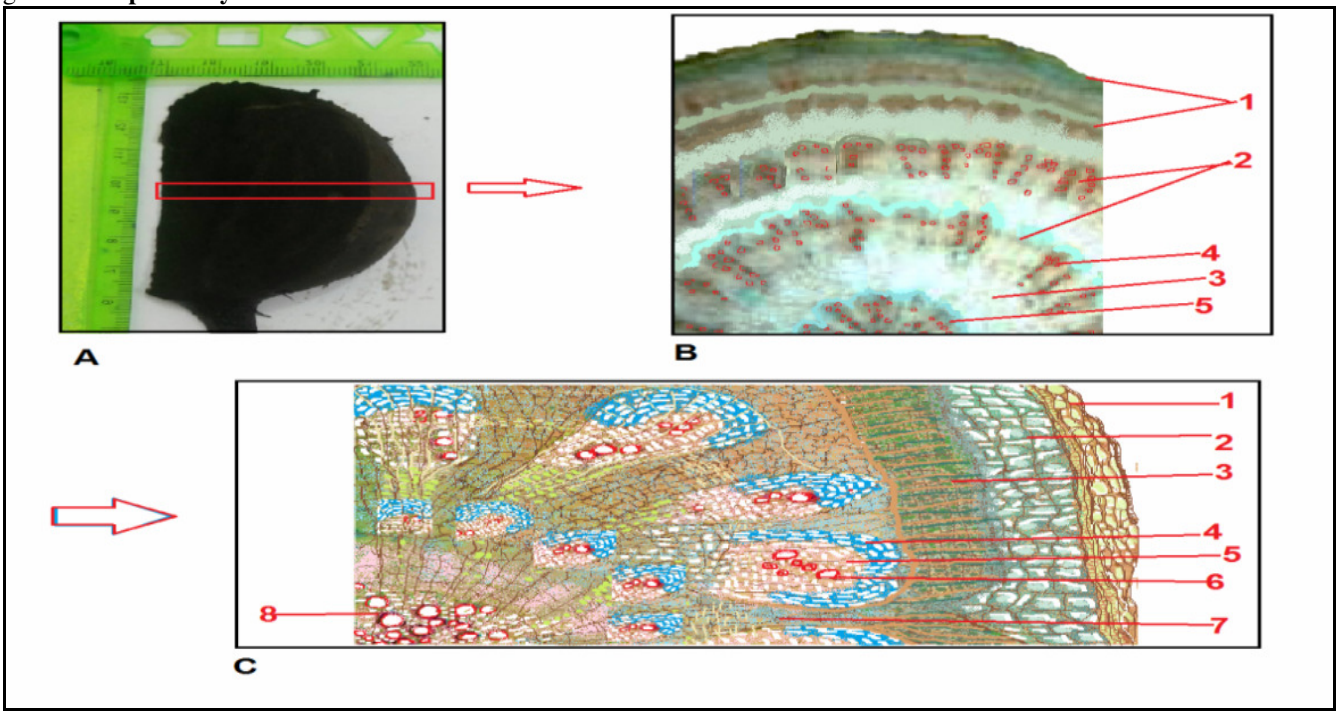

Plate 9 : (A)Showing beet plant root as a general shape of root (B) **A cross section of the root** treatment of K1B0 under 10X magnification, showing 1 = peripheral epidermis, 2 = growth rings, 3 = **parenchyma** tissue, 4 = vascular bundle, (C) Showing 1 = epidermis, 2 = chromium, 3 = cork, 4 = phylem tissue, 5 = vascular cambium, 6 = xylem tissue, 7 = **parenchyma** tissue, and 8 = central vascular bundle**.**

Anatomical evolution

In this study, the anatomical development of peripheral epidermis thickness, number of growth rings, development of parenchyma and cork cells in growth, the results show that Plate (10) showing that the plant contains two growth rings and compared with the rest plate, this treatment showed less thickness of the peripheral epidermis and thickness of the parenchyma where V2 is better than V1 in terms of development of epidermis and cork and secondary growth.

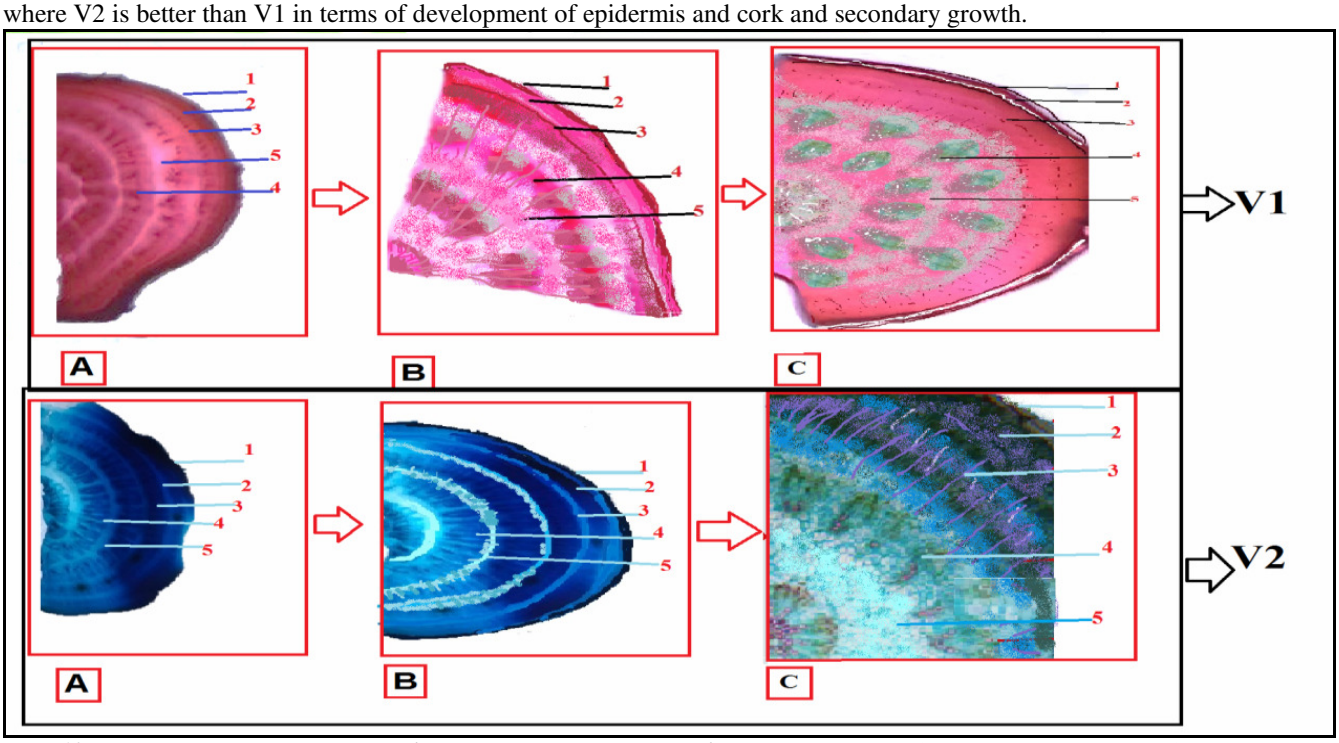

Plate 10 : Beet varieties (V1) the local **variety** and (V2) the imported **variety** in the treatment of KOBO under 10X magnification, showing 1 = Pheloderm, 2 = Phelognen, 3 = Cork, 4 = Vascular bundle and 5= parenchyma tissue, Plate A= represents the root of the beet after 8 weeks of planting and plate B= represents the root of the beet after 10 weeks of planting and plate C =represents the root of the beet after 12 weeks of planting.

Plate (11) showing that the plant contains two growth rings and compared to the rest plate, this treatment showed a relatively midle measurement of the peripheral epidermis thickness, the average thickness of rings growth in secondary growth and thickness of parenchyma is relatively small and equal in two studied **variety**.

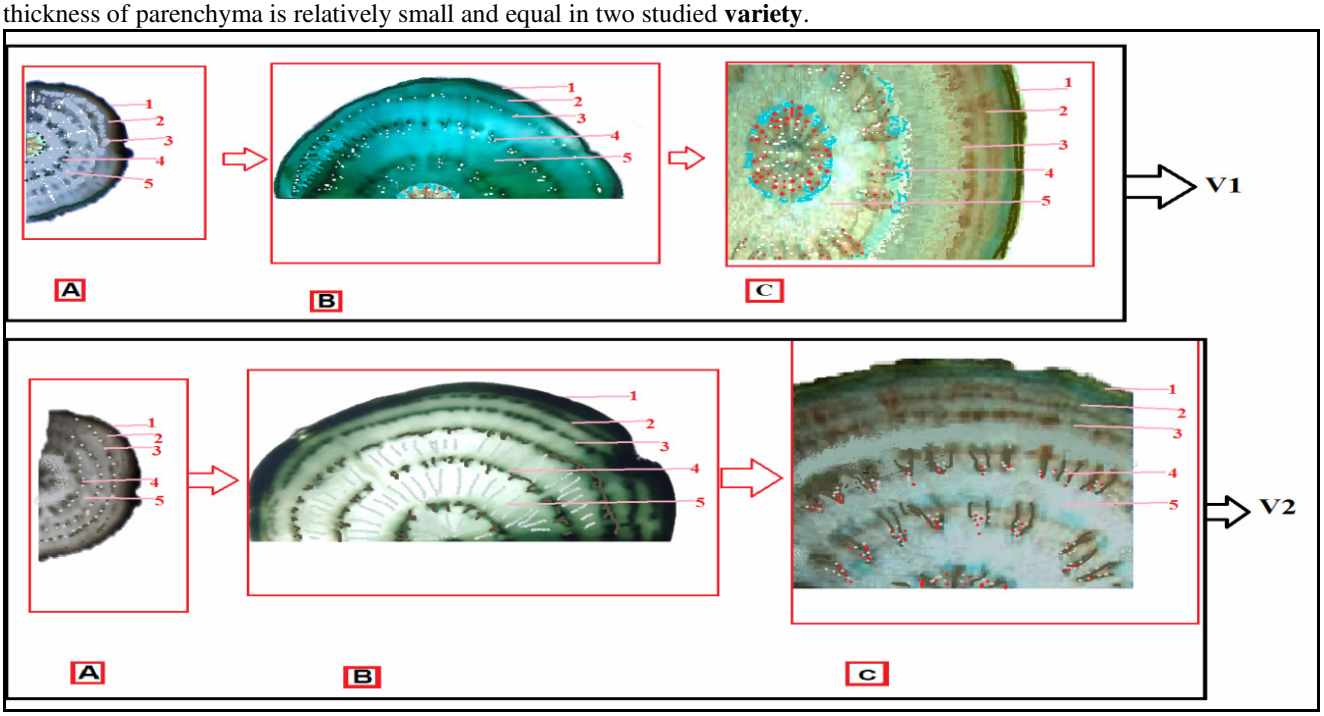

Plate 11 : Beet varieties (V1) the local **variety** and (V2) the imported **variety** in the B1K0 treatment of KOB1under 10X magnification, showing 1 = Pheloderm, 2 = Phelognen, 3 = Cork, 4 = Vascular bundle and 5= parenchyma tissue, Plate A= represents the root of the beet after 8 weeks of planting and plate B= represents the root of the sugar beet after 10 weeks of planting and plate C =represents the root of the sugar beet after 12 weeks of planting.

Plate (12) showing that the plant contains two growth rings and compared to the rest plate , this treatment showed the highest measure of secondary growth and peripheral epidermis thickness, while secondary growth and thickness of parenchyma is relatively small and equal in these results of the two variety studied.

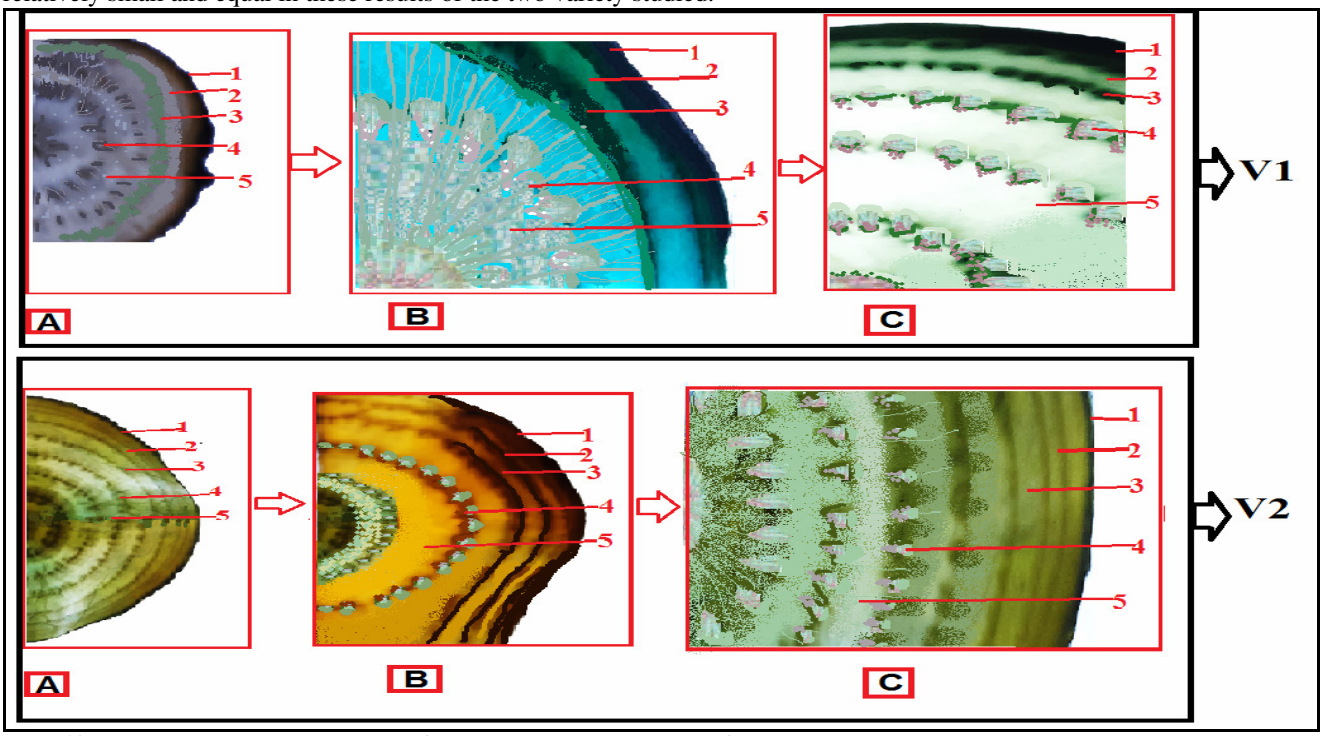

Plate 12 : Beet varieties (V1) the local **variety** and (V2) the imported **variety** in the B2K0 treatment of K0BS under 10X magnification, showing 1 = Pheloderm, 2 = Phelognen, 3 = Cork, 4 = Vascular bundle and 5= parenchyma tissue, Plate A= represents the root of the sugar beet after 8 weeks of planting and plate B= represents the root of the sugar beet after 10 weeks of planting and plate C =represents the root of the sugar beet after 12 weeks of planting**.**

Note that compared with the rest plates, this treatment showed the highest mean thickness of the growth rings and growth rings diameter of secondary growth and thickness of the parenchyma, the thickness of the peripheral epidermis is relatively midle . The local variety on the importer in the development of cork and secondary epidermis where after Week 10 The growth of cork and peripheral epidermis was completed(Plate, 13).

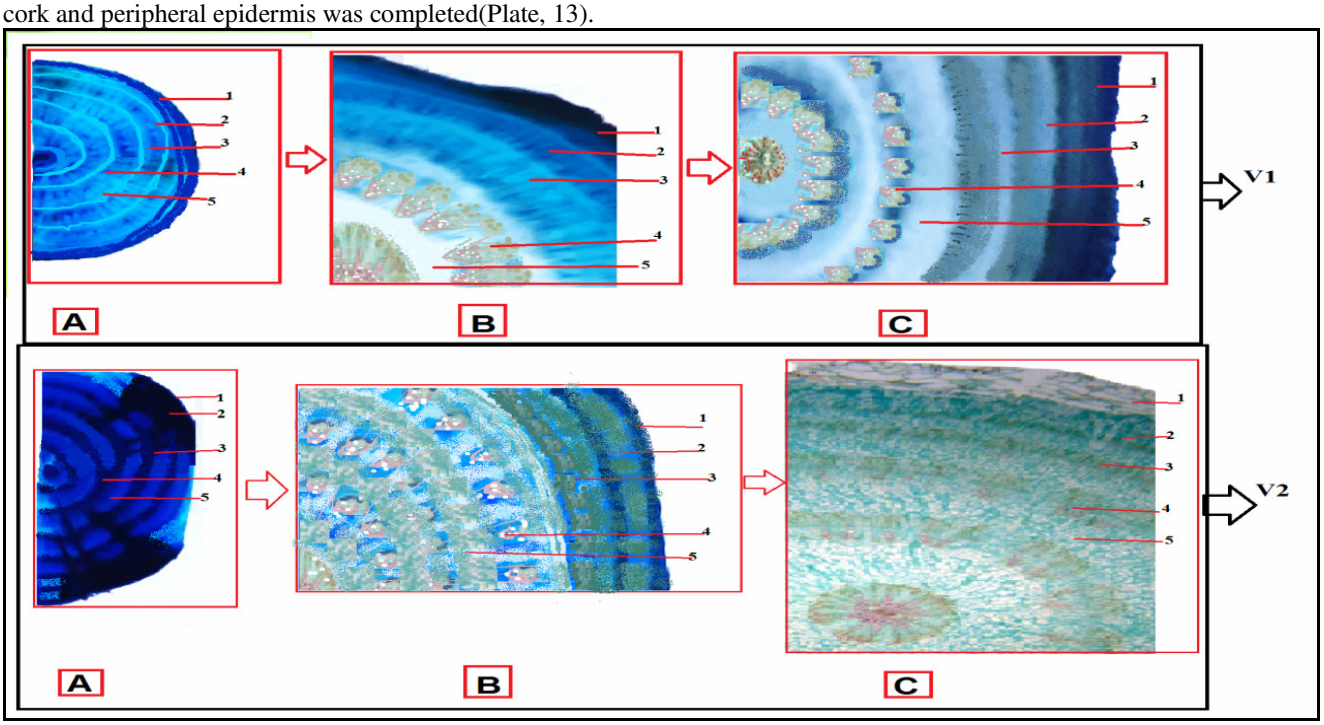

Plate 13 : (sugar beet) ***Beta vulgaris* L.** (V1) the local **variety** and (V2) the imported **variety** in the B2K2 treatment under 10X magnification, showing 1 = Pheloderm, 2 = Phelognen, 3 = Cork, 4 = Vascular bundle and 5= parenchyma tissue, plate A= represents the root of the sugar beet after 8 weeks of planting and plate B= represents the root of the sugar beet after 10 weeks of planting and plate C =represents the root of the sugar beet after 12 weeks of planting**.**

Note that the plant contains two growth rings and compared to the rest plate , this treatment showed a minimum measure of the thickness of the peripheral epidermis, the average thickness of growth rings in secondary growth and thickness of parenchyma is relatively midle and the development of parenchyma tissue in the imported category better than the local week twelveth (Plate, 14).

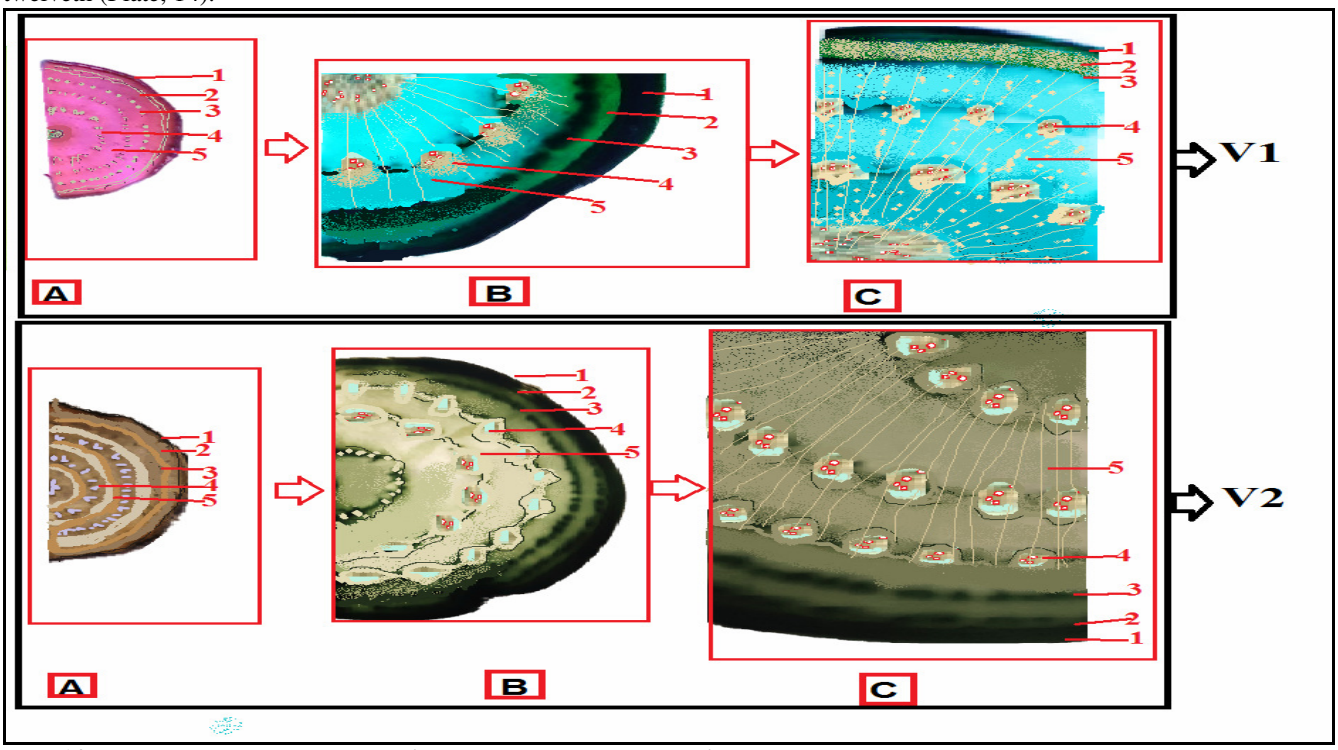

Plate 14 : Beet varieties (V1) the local **variety** and (V2) the imported **variety** in the B0K2 treatment under 10X magnification, showing 1 = Pheloderm, 2 = Phelognen, 3 = Cork, 4 = Vascular bundle and 5= parenchyma tissue, Plate A= represents the root of the sugar beet after 8 weeks of planting and plate B= represents the root of the sugar beet after 10 weeks of planting and plate C =represents the root of the sugar beet after 12 weeks of planting**.**

Plate 15, showing that the plant contains three growth rings. Compared with the rest plates, relatively high measurements were shown in the thickness of the growth rings in secondary growth and the thickness of the parenchyma . The thickness of the peripheral epidermis is relatively midle. The local variety showed rapid growth and development after the eighth week and this was shown in irregular vascular bundles in this plate.

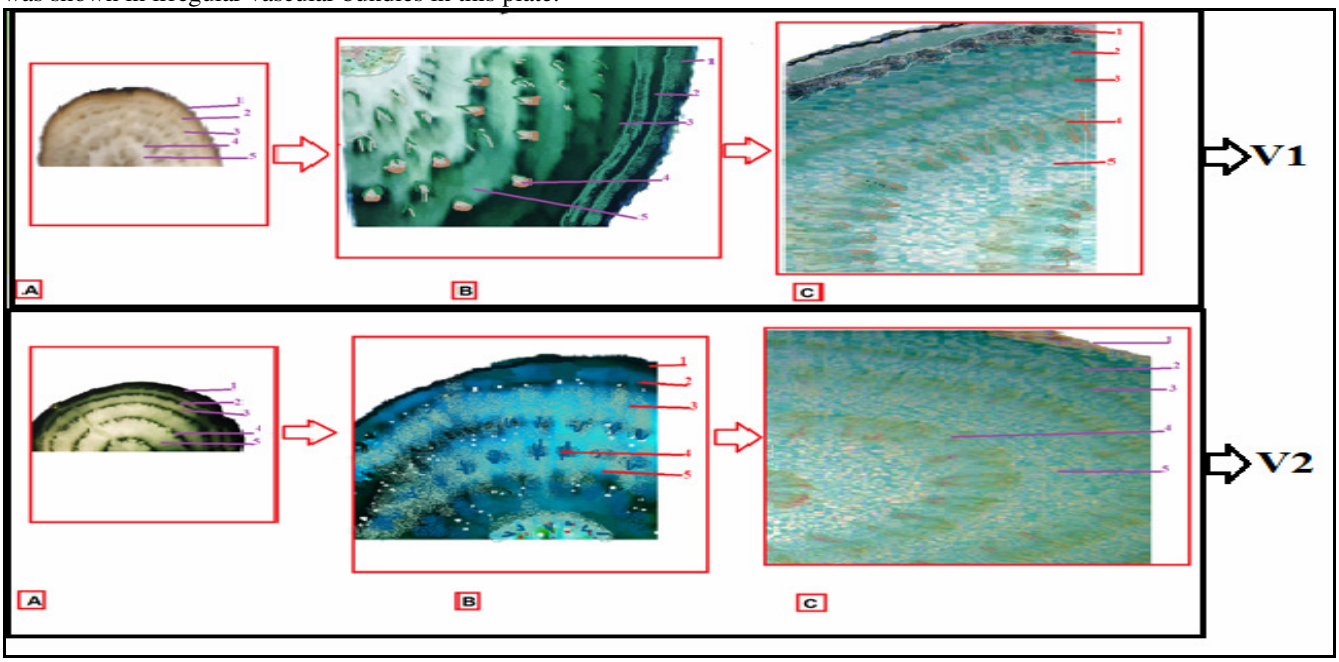

Plate 15 : Beet varieties (V1) the local **variety** and (V2) the imported **variety** in the B1K2 treatment under 10X magnification, showing 1 = Pheloderm, 2 = Phelognen, 3 = Cork, 4 = Vascular bundle and 5= parenchyma tissue, plate A= represents the root of the sugar beet after 8 weeks of planting and plate B= represents the root of the sugar beet after 10 weeks of planting and plate C =represents the root of the sugar beet after 12 weeks of planting**.**

Plate (16) showing that the plant contains two growth rings and compared to the rest plate , this treatment showed relatively moderate measurements in the thickness of the peripheral epidermis and the thickness of growth rings in secondary growth and thickness of the parenchyma.

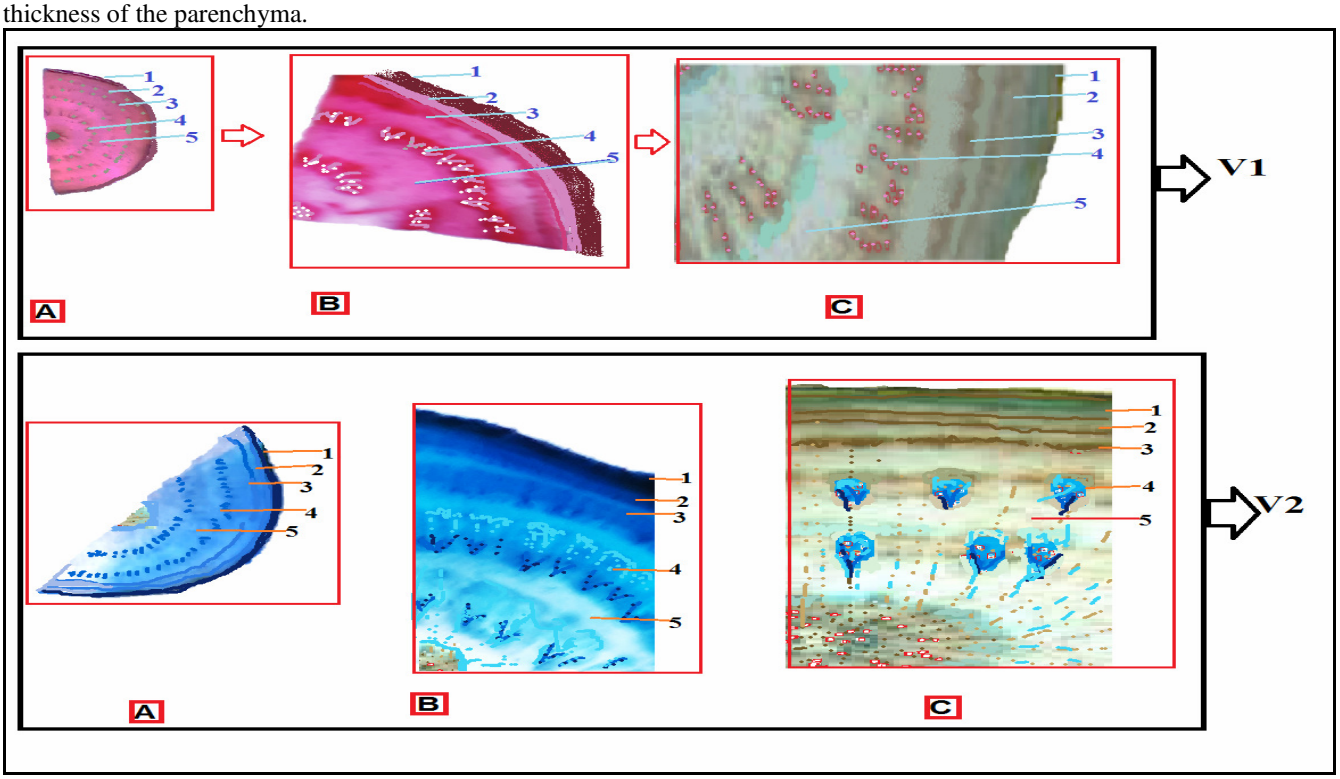

Plate 16 : Beet varieties (V1) the local **variety** and (V2) the imported **variety** in the B2K1 treatment under 10X magnification, showing 1 = Pheloderm, 2 = Phelognen, 3 = Cork, 4 = Vascular bundle and 5= parenchyma tissue, Plate A= represents the root of the sugar beet after 8 weeks of planting and plate B= represents the root of the sugar beet after 10 weeks of planting and plate C =represents the root of the sugar beet after 12 weeks of planting.

Plate 17, showing that the plant has four growth rings. Compared to the rest plates, this treatment showed relatively moderate measurements of secondary growth and peripheral epidermis thickness and high measurements in the average thickness of growth rings in secondary growth and parenchyma thickness. The imported cultivar was superior in the development of the parenchyma in the 12th week.

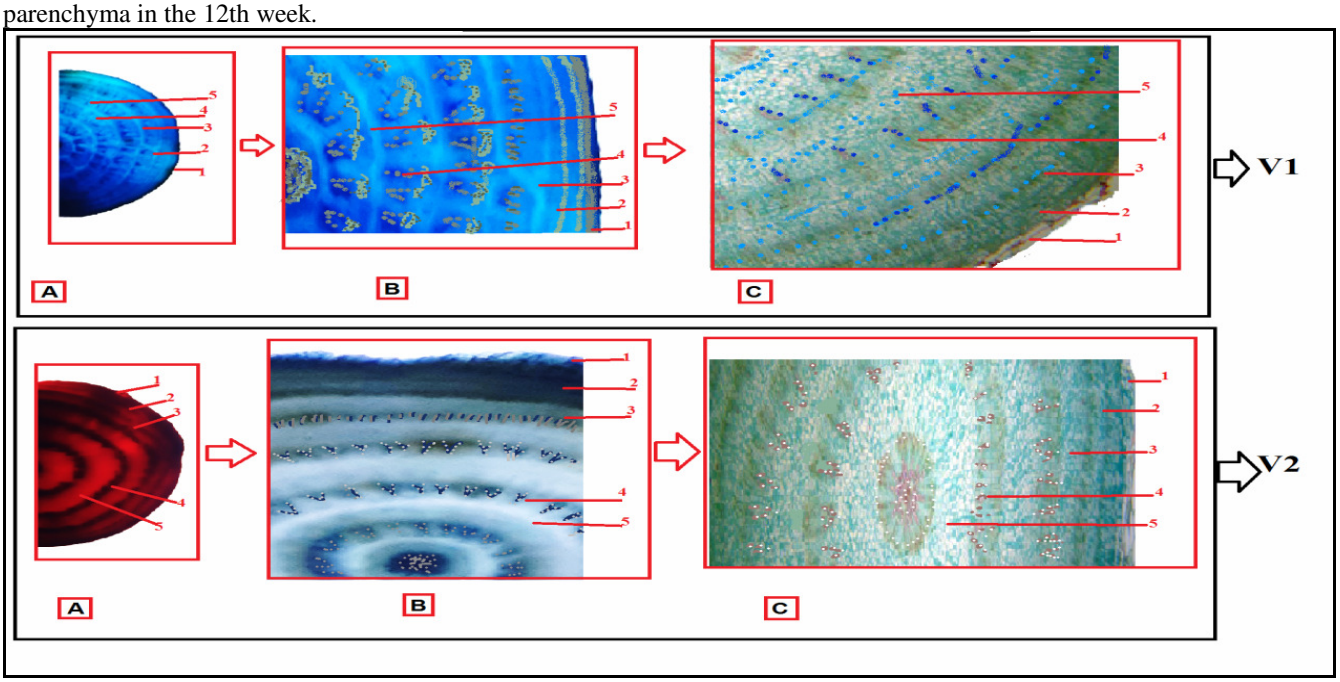

Plate 17 : Beet varieties (V1) the local **variety** and (V2) the imported **variety** in the B1K1 treatment under 10X magnification, showing 1 = Pheloderm, 2 = Phelognen, 3 = Cork, 4 = Vascular bundle and 5= parenchyma tissue, Plate A= represents the root of the sugar beet after 8 weeks of planting and plate B= represents the root of the sugar beet after 10 weeks of planting and plate C =represents the root of the sugar beet after 12 weeks of planting.

Plate (18) showing that the plant contains two growth rings and compared to the rest plate, this treatment showed relatively few measurements in secondary growth and peripheral epidermis thickness and relatively moderate measurements in the thickness of the growth rings of secondary growth and the thickness of parenchyma tissue. Both variety of study are equal in evolution.

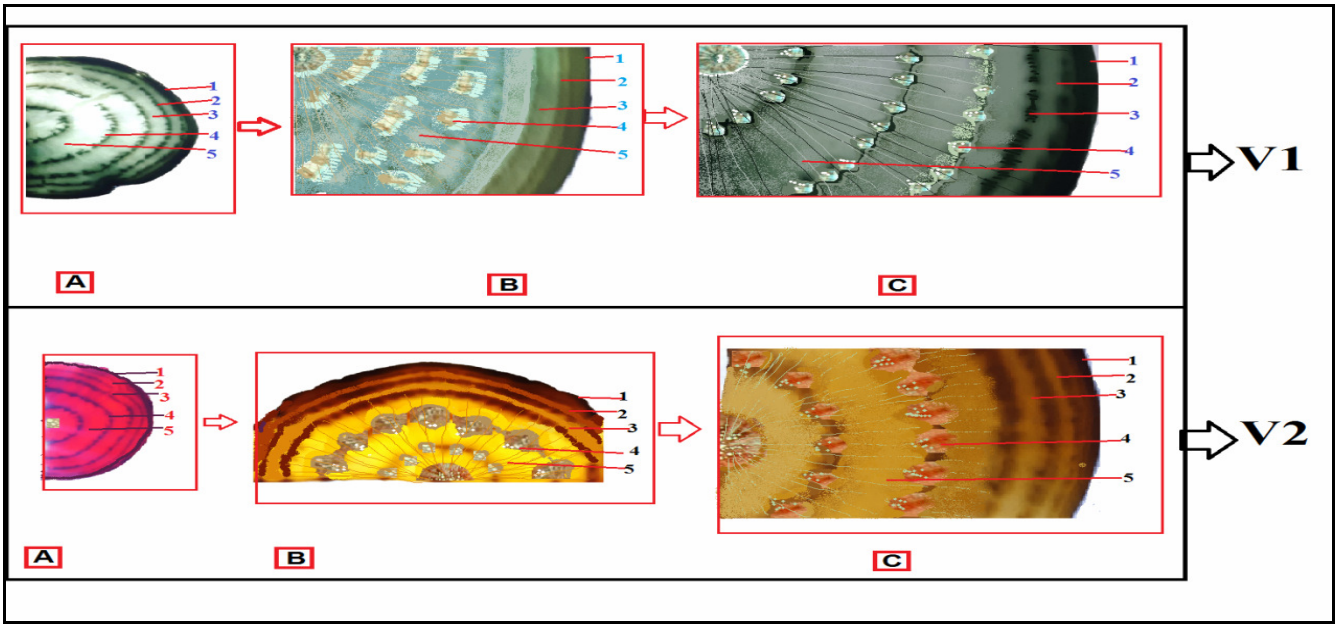

Plate 18 : Beet varieties(V1) the local **variety** and (V2) the imported **variety** in the B0K1 treatment under 10X magnification, showing 1 = Pheloderm, 2 = Phelognen, 3 = Cork, 4 = Vascular bundle and 5= parenchyma tissue, Plate A= represents the root of the sugar beet after 8 weeks of planting and plate B= represents the root of the sugar beet after 10 weeks of planting and plate C =represents the root of the sugar beet after 12 weeks of planting**.**

Conclusions

In the previous results, the studied plants have differed markedly in the mean number of vascular bundles, number of growth rings in secondary growth, vessel diameter in secondary growth, peripheral epidermis thickness and parenchyma thickness

K2B2, K1B1 showed the higher mean number of vascular bundles, growth ring thickness, diameter, number of growth rings in secondary growth and parenchyma thickness. This shows the synergism effect of both boron and potassium in improving plant growth.

K0B2 showed the highest vessel diameter in secondary growth and peripheral epidermis thickness. This clearly indicates the role of boron in the production of vectors and enzymes that stimulate the production of materials for the construction of supporting tissues.

Potassium concentrates showed the highest measurements of parenchyma. This indicates the role of potassium in the transport and storage of metabolites in parenchyma.

These results have emerged because of the important role of boron and potassium mineral fertilizers and their overlap in improving root growth and increasing cell division and elongation (Matlob *et al.,* 1989). Because boron and potassium improves nutrient absorption of plants not only for micronutrients, but also for other nutrients. These results are supported by similar results obtained from studies (Armin and Asgharipour, 2011) and (Attarde *et al.,* 2012).

Acknowledgement

This study is supported by Department of Horticulture and Landscape Design, Faculty of Agriculture, University of Kufa, Republic of Iraq, as a part of Ph.D. program. And was translated by Dr. Muthik A. Guda in the Department of Ecology Lap. We thank Dr. Muthik and all the members in plant anatomy laboratory in Biology Department for helping to complete that study.

References

Abdelaal, Kh. A.A.; Shimaa, A.B. and Neana, S.M. (2015). Effect of foliar application of microelements and potassium levels on growth, physiological and quality characters of sugar beet (Beta vulgaris L.) under newly reclaimed soils, J. Plant Production, Mansoura Univ., Eygpt. 6(1): 1259-1280.

Abo El-Nasr, M.E. and Ibrahim, E.A. (2015). Effect of different potassium fertilizer rates and foliar application with some sources of potassium on growth, yield and quality of Carrot plants (*Daucus carota* L.). J. Plant Production, Mansoura Univ., 2(4): 559-569.

Agamy, R.; Hashem, M. and Alamri, S. (2013). Effect of soil amendment with yeasts as bio-fertilizers on the growth and productivity of sugar beet. African Journal of Agricultural Research, 8(1): 46-56.

Al-Rawi, K.M. and Khalaf-Alla, A. (2000). Design and Analysis of Agricultural Experiments. College of Agriculture and Forestry. University of Mousel. Iraq. 487.

Armin, M. and Asgharipour, M.R. (2011). Effect of time and concentration of boron foliar application on yield and quality of Sugar Beet. Asian Journal of Plant Sci.,10(5): 307-311.

Attarde, S.B.; Narkhede, S.D.; Patil, R.P. and Ingle, S.T. (2012). Effect of organic and inorganic fertilizers on the growth and nutrient content of *Abelmoschus esculentus* L. (Okra Crop). International Journal of Current Research, 4(10): 137-140.

Black, G.R. (1965). Bulk density (in. C. A. Black.(eds). Methods of Soil analysis. Part 1. Agron. Mono. No.9(1): 374- 390. Am. Soc. Agro).

Cakmak, I. (2005). The role of potassium in alleviating detrimental effects of abiotic stresses in plants. Journal of Plant Nutrition and Soil Science, 168: 521-530.

Cloete, K.J.; Valentine, A.J.; Stander, M.A.; Blomerus, L.M. and Botha, A. (2009). Evidence of symbiosis between the soil yeast *Cryptococcus laurentii* and a sclerophyllous medicinal shrub, *Agathosma betulina* (Berg). Pillans. Microb. Ecol., 57: 624-632.

El-Nagdy, G.A.; Nassar, D.M.; Elkady, E.A. and El-Yamanee, G.S.A. (2010). Response of flax plant (*Linum usitatissimum* L.) to treatments with mineral and bio-fertilizers from nitrogen and phosphorus. Journal of American Science, 6(10): 207-216.

Gehan, A.; Elham, A.; Badr, B. and Afifi, M.H.M. (2013). Root yield and quality of Sugar Beet (*Beta vulgaris* L.), in Response to biofertilizer and foliar application with micronutrients. World Applied Science Journal, 27(11): 1385-1389.

Guda, M.A.; Merza, T. and Almayahi, B. (2016). Response of non-enzymatic antioxidants to *Phragmites australis* (Cav.) Trin. Ex. strudels plants of the environmental stresses in Baher Alnajaf, Iraq. Plant Cell Biotech. Molec. Biol., 17: 140-148.

Guda, A.M.; Mutlag, N.H. and Alasedi, K.K. (2018). The potential use of *Atriplex nummularia* plant as contamination indicators of heavy metal in different soils. Plant Archives, 18(2): 2372-2378.

Matlob, A.N.; Saltan, A. and Abdol, K.S. (1989). Vegetable Production. House book for Publishing and Distribution. University of Mousel. Ministry of High Education and Scientific Research. Iraq.