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# Effect of seedling age and NPK fertilizer on qualitative of Kohlrabi (*Brassica oleracea* var.gongylodes) grown under drip irrigation system

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**KEY WORDS:**
TSS, NPK, carbohydrates, drip irrigation, knob

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## ABSTRACT

Field experiment was conducted on Kohlrabi (*Brassica oleracea* var. gongylodes) 'White Vienna cv.' at the Experimental Station of the Department of Horticulture and Landscape, College of Agriculture, Tikrit University, Salah al-Din, Iraq, during the winter season of 2021-2022 under drip irrigation system. This study aimed to investigate the effect of seedling age (45, 60 and 75 days) and different combination of NPK (60:40:0, 70:50:20, 80:60:30, 90:70:40, 100:80:50 and 120:90:50 kg $ha^{-1}$) on qualitative of kohlrabi plants. The experiment was carried ou according to Randomized Complete Block Design (RCBD) with three replications. The comparison of means was performed by Duncan at a P≤ 0.05 probability level. Results showed that seedling age 45 days increased significantly in the percentages of nitrogen in the leaves, phosphorus and potassium, total dissolved solids (TSS) in knob, content of vitamin C in knob and carbohydrates in the knob which were 3.045%, 0.425%, 3.868%, 6.333%, 0.389 mg $ml^{-1}$ and 6.204% respectively. On the other hand, using combination fertilizer of NPK at level 120:90:50 kg $ha^{-1}$, gave significant increment in all studied characteristics. Interaction treatment between seedling age 45 days and combination fertilizer of NPK at 120:90:50 kg $ha^{-1}$ recorded highest values in all studied characteristics of qualitative for kohlrabi plant except the percentage of nitrogen in leaves. Whereas, seedling age 60 days and combination fertilizer of NPK at 120:90:50 kg $ha^{-1}$ showed significant superiority in the percentage of nitrogen in leaves 5.533%.

# تأثير عمر الشتلة والسماد NPK على نوعية الكلم (*Brassica oleracea* var.gongylodes) المزروع تحت نظام الري بالتنقيط

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**الخلاصة**

أجريت التجربة على محصول الكلم Kohlrabi (*Brassica oleracea* var. gongylodes) صنف White Vienna في محطة الأبحاث التابعة لقسم البستنة وهندسة الحدائق، كلية الزراعة، جامعة تكريت، صلاح الدين، العراق، خلال فصل الشتاء. 2021-2022 تحت نظام الري بالتنقيط. هدفت الدراسة إلى معرفة تأثير عمر الشتلات (45 و 60 و 75 يوم) والتوليفات المختلفة من NPK (60:40:0 و 70:50:20 و 80:60:30 و 90:70:40 و 100:80:50 و 120:90:50 كغم هكتار$^{-1}$) على نوعية نبات الكلم. نفذت التجربة حسب تصميم القطاعات العشوائية الكاملة (RCBD) وبثلاثة مكررات. تم المقارنة بين المتوسطات حسب اختبار دنكن متعدد الحدول و عند مستوى احتمالية 5%. أظهرت النتائج أن عمر الشتلة 45 يومًا زاد معنويا في نسبة النيتروجين والفوسفور والبوتاسيوم في الأوراق والمواد الصلبة الذائبة الكلية (TSS) ومحتوى فيتامين C والكربوهيدرات في السيقان المتضخمة أذ بلغت 3.045% و 0.425% و 3.868% و 6.333% و 0.389 ملغم 100مل$^{-1}$ و 6.204% على التوالي. من ناحية أخرى، فإن استخدام توليفة السماد من NPK 120: 90: 50 كغم هكتار$^{-1}$ أعطت زيادة معنوية في جميع الصفات المدروسة. وفيما يخص معاملات التداخل، فقد سجلت معاملة التداخل بين عمر الشتلة 45 يوم وتوليفة السماد NPK عند 120: 90: 50 كغم هكتار$^{-1}$ أعلى القيم في جميع الصفات النوعية المدروسة لنبات الكلم باستثناء نسبة النيتروجين في الأوراق. حيث أظهرت معاملة عمر الشتلة 60 يوم وتوليفة السماد NPK عند 120: 90: 50 كغم هكتار$^{-1}$ تفوقاً معنوياً في نسبة النيتروجين في الأوراق 5.533%..

**الكلمات المفتاحية:** TSS ، NPK، الكربوهيدرات، الري بالتنقيط، السيقان المتضخمة.

## INTRODUCTION

Kohlrabi (*Brassica oleracea* var. gongylodes) is one member of a mustard family. It is one of winter vegetable crop. And it is grown in Iraq in the fall and spring seasons because of its tolerance of temperatures a wide range (Al-Kinani, 1988 ; Al-Raqabi *et al*., 1981). It is one of the important crops because it contains a medicinal and nutritional value. It contains a good amount of potassium, vitamin C and antioxidants that prevent cancer (Beecher, 1994). Cultivation of kohlrabi is similar to the cultivation of cruciferous crops. Although it is grown in large areas in Europe and America, in Iraq it is still grown in very limited areas and in small. As its cultivation in Iraq is limited to some governorates such as Karbala, Babylon and Baghdad (Al-Khafaji and Al-Mukhtar, 1989). The edible part of the kohlrabi is the enlarged stem that grows above the surface of the soil, which is called the knob. There are many factors that affect on the quality of any crop, including weather factors such as temperature, humidity and lighting. Also ther are many agricultural factors such as the variety, size of the seedling, its age, the amount of fertilizer used, the method of adding it, planting distances...etc.

The age of the seedling is one of the important agricultural factors that determine the productivity and quality of the crop. As small seedlings may not tolerante the transplanting process or difficult field conditions, which consequently lead to their death. Also, the use of old seedlings may lead to some mechanical damage, difficulty in adapting in the field condition and delaying it for a long period of stay in the nursery (Anonymous, 1992). Therefore, planting seedlings at the optimum age leads to better quality. Wlazlo and Kunicki (2003) concluded in an experiment they carried out on broccoli that planting seedlings at a young age leads to improvement in quality.

Fertilization is also considered one of the important agricultural factors affecting on the quality of the crop, and since the plant of kohlrabi is one of the plants that needs nutrients in all stages of its growth, especially NPK (Sultana *et al*., 2012). Also, the use of mineral fertilizers is still the most common in the world, especially in vegetable fields, due to its rapid absorption by the plant, its ease of use, and the supply of the plant with the required nutrients (Magdoff and Weil, 2004).

Based on the foregoing, the idea of this research was to find out the effect of the age of the seedling and the optimal fertilizer combination on the quality of the kohlrabi crop.

## MATERIALS AND METHODS

### The Location of Experiment

The experiment was conducted during agricultural season 2021-2022 at the experiment station - Department of Horticulture and Landscape – College of Agriculture – Tikrit University, Tikrit city, Salah al-Din governate, Iraq. The coordinates of the experimental station on latitude 34$^{o}$ 40$^{/}$ 51.93$^{//}$ N and longitude 43$^{o}$ 38$^{/}$ 59.87$^{//}$ E. The data associated with the properties of soil is as shown in Table 1.

**Table 1: Physical and chemical analyses of the experimental soi**

| Soil Texture | | | | pH | EC | CEC | OM | Lime | Gypsum | N | P | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sand (g kg$^{-1}$) soil | Silt (g kg$^{-1}$) | Clay (g kg$^{-1}$) | Texture | | (ds m$^{-1}$) | (cmol kg$^{-1}$ soil) | | (g kg$^{-1}$ soil) | (g kg$^{-1}$ soil) | (mg kg$^{-1}$ soil) | (mg kg$^{-1}$ soil) | (mg kg$^{-1}$ soil) |
| 520 | 341 | 139 | Loam | 8 | 3.04 | 21 | 2.16 | 175 | 156.16 | 41.09 | 5.06 | 125.66 |

### Experimental Design and Field Layout

The experiment consisted of two factors are seedling age and different fertilizer combination of NPK. The first factor included three ages of seedling viz, 45 days, 60 days and 75 days. The second factor consisted six fertilizer combination of NPK namely, 60:40:0, 70:50:20, 80:60:30, 90:70:40, 100:80:50 and 120:90:50 kg ha$^{-1}$.The experiment was laid out according to Randomized Complete Block Design (RCBD) with three replicates. The experiment was divided into three blocks, and each block consisted of two ridges, the length of one ridge was 26.5 m, the width of the ridge was 50 cm, the distance between one ridge and another was 1 m, the distance between an experimental unit and another was 0.5 m in each ridge, the area of experimental unit was 3m2, the number of plants in each experimental unit were 10, the distance between plant and other 25 cm. The drip irrigation system was installed along the ridge.

### Application of Treatments

The seeds of kohlrabi (White Vienna cv.) were planted in seedling trays on 16/8/2021. When the seedlings reached the appropriate age, they were transferred to the field for planting. The seedlings were planted at the age of (45) days on 30/9/2021, seedlings at the age of (60) days on 15/10/2022 and seedlings at the age of (75) days on 30/10/2022. N was applied in two doses (1/2 after one month of seedlings planting and a month after the addition of the fertilizer, the second batch of was added), while the other mineral fertilizers applied one does after one month of seedlings planting. N in the form of urea (46% N), P in the form of triple super phosphate (21% P) and K in the form potassium sulfate (43% k).

### Measurements of Quality Parameters

Percentage of nitrogen in the leaves (%), percentage of phosphorous in the leaves (%), percentage of potassium in the leaves (%), total dissolved solids (TSS) in knob (%), content of vitamin C in knob (mg 100ml$^{-1}$ ), acidity in the knob (mg L$^{-1}$) and percentage of carbohydrates in the knob(%).

**Statistical Analysis**

The collected data were analyzed using analysis of variance (ANOVA) for a Randomized Complete Block Design with three replicates with the SAS software package (version 9.0). The comparison of means was performed by Duncan at a P≤ 0.05 probability level

## RESULT AND DISCUSSION

The changes to the percentage of nitrogen in the leaves of kohlrabi plants in response to the seedling age are presented in Table 2. The seedlings age 45 days were greater 3.045%, but there was no significant difference with seedlings age 60 days. whereas, the seedlings age 75 days had smallest value 2.496%.

Table 2. Effect of seedling age, fertilizers combination of NPK and interaction between them on percentage of nitrogen in the leaves (%)

| Treatment | 60:40:0 N:P:K | 70:50:20 N:P:K | 80:60:30 N:P:K | 90:70:40 N:P:K | 100:80:50 N:P:K | 120:90:50 N:P:K | Mean |
|---|---|---|---|---|---|---|---|
| 45 Days | 2.066 f | 2.433 ef | 3.767 b | 3.367 bc | 2.767 de | 3.867 b | 3.045 a |
| 60 Days | 2.067 f | 2.430 ef | 2.800 de | 2.293 ef | 2.400 ef | 5.533 a | 2.921 a |
| 75 Days | 1.533 f | 2.000 f | 3.133 cd | 2.377 ef | 2.333 ef | 3.600 bc | 2.496 b |
| Mean | 1.889 e | 2.288 d | 3.233 b | 2.679 c | 2.500 cd | 4.333 a | |

* Different alphabets in the same column show significant difference using Duncan's Multiple Range test (P≤ 0.05)

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The results also showed the superiority of the plants that had been planted at fertilizer combination of NPK 120:90:50 kg $ha^{-1}$ compared to other fertilizer combinations. While, fertilizer combination of NPK 60:40:0 kg $ha^{-1}$ had lowest value 1.889%. On the other hand, the interaction treatment between seedling age 60 days and fertilizer combination of NPK 120:90:50 kg $ha^{-1}$ recorded highest value in the percentage of nitrogen in the leaves 5.533%. Meanwhile, the interaction treatment between seedling age 75 days and fertilizer combination of NPK 60:40:0kg $ha^{-1}$ gave lowest value 1.533%. The results in Table. 3 indicate that seedling age 75 days reduced significantly in percentage of phosphorus in the leaves 0.281%, but there was no significant difference with seedling age 60 days. At the same time, seedling age 45 days showed significant increment 0.425%.

Also, the same table refers that fertilizer combination of NPK 120:90:50 kg $ha^{-1}$ increased significantly in percentage of phosphorus in the leaves 0.513%, but there was no significant difference with fertilizer combination of NPK 80:60:30 kg $ha^{-1}$. Meanwhile, fertilizer combination of NPK 60:40:0 kg $ha^{-1}$ had lowest value which was 0.172%. As for the interaction treatments, the table shows that interaction treatment between seedlings age 45 days and fertilizer combination of NPK 120:90:50 kg $ha^{-1}$ had highest value 0.667%. Whereas, the interaction treatment between seedlings age 75 days and fertilizer combination of NPK 60:40:0 kg $ha^{-1}$ had lowest value 0.123%. The study factors in their effect on the potassium percentage in the leaves behaved the same as in their effect on the phosphorus percentage in the leaves (Table 4.).

Table 3. Effect of seedling age, fertilizers combination of NPK and interaction between them on percentage of phosphorous in the leaves (%)

| **Treatment** | **60:40:0 N:P:K** | **70:50:20 N:P:K** | **80:60:30 N:P:K** | **90:70:40 N:P:K** | **100:80:50 N:P:K** | **120:90:50 N:P:K** | **Mean** |
|---|---|---|---|---|---|---|---|
| 45 Days | 0.237 efgh | 0.417 bcd | 0.500 b | 0.410 bcd | 0.320 cdefg | 0.667 a | 0.425 a |
| 60 Days | 0.157 gh | 0.233 efgh | 0.417 bcd | 0.343 bcdef | 0.270 defgh | 0.473 bc | 0.316 b |
| 75 Days | 0.123 h | 0.220 fgh | 0.370 bcdef | 0.290 defgh | 0.280 defgh | 0.400 bcde | 0.281 b |
| Mean | 0.172 d | 0.290 c | 0.429 ab | 0.348 bc | 0.290 c | 0.513 a | |

* Different alphabets in the same column show significant difference using Duncan's Multiple Range test (P≤ 0.05)

Where the treatments of seedling age 45 days, fertilizer combination of NPK 120:90:50 kg $ha^{-1}$ and interaction between them had given greatest values 3.868%, 4.591% and 5.709% respectively. In contrast, seedling age 75 days, fertilizer combination of NPK 60:40:0 kg $ha^{-1}$ and interaction between them had given smallest values 2.456%, 1.923% and 1.414 respectively.

Table 4. Effect of seedling age, fertilizers combination of NPK and interaction between them on percentage of potassium in the leaves (%)

| **Treatment** | **60:40:0 N:P:K** | **70:50:20 N:P:K** | **80:60:30 N:P:K** | **90:70:40 N:P:K** | **100:80:50 N:P:K** | **120:90:50 N:P:K** | **Mean** |
|---|---|---|---|---|---|---|---|
| 45 Days | 2.881 efg | 3.392 cdef | 4.791 b | 3.583 cde | 2.850 efg | 5.709 a | 3.868 a |
| 60 Days | 1.475 ij | 3.023 defg | 3.765 cd | 2.849 efg | 2.605 fg | 4.162 bc | 2.980 b |
| 75 Days | 1.414 j | 1.770 hij | 2.994 defg | 2.422 gh | 2.233 ghi | 3.901 c | 2.456 c |
| Mean | 1.923 d | 2.728 c | 3.850 b | 2.951 c | 2.563 c | 4.591 a | |

* Different alphabets in the same column show significant difference using Duncan's Multiple Range test (P≤ 0.05)

The total dissolved solids (TSS) in knob was 6.333% for those cultivated at seedlings age 45 days, and 4.206% for the seedling age 75 day (Table 5). The kohlrabi knobs at the fertilizer combination of NPK 120:90:50 kg $ha^{-1}$ had the highest total dissolved solids (TSS). In contrast, the fertilizer combination of NPK 60:40:0 kg $ha^{-1}$ had the lowest total dissolved solids (TSS). There was a significant difference in the total dissolved solids (TSS) in knobs, with those planted in 45 days at level 120:90:50 kg $ha^{-1}$ of NPK , having the highest 8.833%, and those planted in 75 days at level 60:40:0 kg $ha^{-1}$ of NPK, having the least 3.000%. Effect of seedling age on content of vitamin C in knob were lower at 60 and 75 days 0.283 and 0.259 mg $100ml^{-1}$ respectively, as compared to 45 days 0.389 mg $100ml^{-1}$ (Table, 6).

Table 5. Effect of seedling age, fertilizers combination of NPK and interaction between them on total dissolved solids (TSS) in knob (%)

| **Treatment** | **60:40:0 N:P:K** | **70:50:20 N:P:K** | **80:60:30 N:P:K** | **90:70:40 N:P:K** | **100:80:50 N:P:K** | **120:90:50 N:P:K** | **Mean** |
|---|---|---|---|---|---|---|---|
| 45 Days | 5.300 de | 5.867 cde | 6.733 bc | 5.600 cde | 5.667 cde | 8.833 a | 6.333 a |
| 60 Days | 3.867 fg | 4.800 ef | 5.667 cde | 5.333 de | 4.800 ef | 7.066 b | 5.256 b |
| 75 Days | 3.000 g | 3.700 fg | 4.667 ef | 4.000 fg | 3.733 fg | 6.133 bcd | 4.206 c |
| Mean | 4.056 d | 4.789 c | 5.689 b | 4.978 c | 4.733 c | 7.344 a | |

* Different alphabets in the same column show significant difference using Duncan's Multiple Range test (P≤ 0.05)

Table 6. Effect of seedling age, fertilizers combination of NPK and interaction between them on content of vitamin C in knob (mg 100ml$^{-1}$)

| **Treatment** | **60:40:0 N:P:K** | **70:50:20 N:P:K** | **80:60:30 N:P:K** | **90:70:40 N:P:K** | **100:80:50 N:P:K** | **120:90:50 N:P:K** | **Mean** |
|---|---|---|---|---|---|---|---|
| 45 Days | 0.381 bc | 0.234 ef | 0.410 b | 0.381 b | 0.352 bcd | 0.574 a | 0.389 a |
| 60 Days | 0.264 def | 0.205 ef | 0.293 cde | 0.234 ef | 0.264 def | 0.440 b | 0.283 b |
| 75 Days | 0.234 ef | 0.176 f | 0.264 def | 0.234 ef | 0.264 def | 0.381 bc | 0.259 b |
| Mean | 0.293 b | 0.205 c | 0.322 b | 0.283 b | 0.293 b | 0.465 a | |

* Different alphabets in the same column show significant difference using Duncan's Multiple Range test (P≤ 0.05)

For fertilizer combination of NPK 120:90:50 kg ha$^{-1}$ reached up 0.465 mg 100 ml$^{-1}$, vitamin C in knob increased, while fertilizer combination of NPK 70:50:20 kg ha$^{-1}$ had variable effect, which were significantly reduced 0.205 mg 100ml$^{-1}$. Table 6. showed the interaction between seedlings age 45 days with fertilizer combination of NPK 120:90:50 kg ha$^{-1}$ significant increment for content of vitamin C in knob, with the highest average of 0.574 mg 100ml$^{-1}$. However, seedlings age 75 days with fertilizer combination of NPK 70:50:20 kg ha$^{-1}$ showed significantly reduce 0.176 mg 100ml$^{-1}$ for content of vitamin C in knob. With regards to acidity in the knob, no significant effect among seedlings age in the acidity in the knob were observed (Table, 7).Table 7. Showed that acidity in the knob treated with the fertilizer combination of NPK 60:40:0 mg L$^{-1}$ was the lowest 0.281 mg L$^{-1}$. But the acidity in the knob treated with the fertilizer combination of NPK 120:90:50 kg ha$^{-1}$were 0.526 mg L$^{-1}$.

Table 7. Effect of seedling age, fertilizers combination of NPK and interaction between them on acidity in the knob (mg $L^{-1}$)

| **Treatment** | **60:40:0 N:P:K** | **70:50:20 N:P:K** | **80:60:30 N:P:K** | **90:70:40 N:P:K** | **100:80:50 N:P:K** | **120:90:50 N:P:K** | **Mean** |
|---|---|---|---|---|---|---|---|
| 45 Days | 0.256 d | 0.384 abcd | 0.469 abc | 0.469 abc | 0.512 ab | 0.554 a | 0.441 a |
| 60 Days | 0.298 cd | 0.341 bcd | 0.383 abcd | 0.426 abcd | 0.384 abcd | 0.469 abc | 0.384 a |
| 75 Days | 0.288 d | 0.340 bcd | 0.425 abcd | 0.382 abcd | 0.384 abcd | 0.554 a | 0.396 a |
| Mean | 0.281 c | 0.355 bc | 0.426 b | 0.426 b | 0.427 b | 0.526 a | |

* Different alphabets in the same column show significant difference using Duncan's Multiple Range test (P≤ 0.05)

On the other hand, the interaction treatment between seedlings age 45 days and fertilizer combination of NPK 60:40:0 kg $ha^{-1}$ reduced significantly in the acidity in the knob. Meanwhile, the interaction treatments between seedlings age 45 and 75 days with same the fertilizer combination of NPK 120:90:50 $ha^{-1}$increased significantly. From Table 8. seedling age at 45 days gave significant increase in the percentage of carbohydrates 6.204% compared to other seedling ages. Also, the fertilizer combination of NPK at level 120:90:50 kg $ha^{-1}$ significantly affected percentage of carbohydrates in the knob compared to other levels. The seedlings age 45 days with fertilizer combination of NPK at level 120:90:50 kg $ha^{-1}$ had highest percentage of carbohydrates in knob, while the reverse was true for seedlings age 75 days with fertilizer combination of NPK at level 60:40:0 kg $ha^{-1}$.

Table 8. Effect of seedling age, fertilizers combination of NPK and interaction between them on percentage of carbohydrates in the knob (%)

| **Treatment** | **60:40:0 N:P:K** | **70:50:20 N:P:K** | **80:60:30 N:P:K** | **90:70:40 N:P:K** | **100:80:50 N:P:K** | **120:90:50 N:P:K** | **Mean** |
|---|---|---|---|---|---|---|---|
| 45 Days | 4.377 efg | 5.360 cde | 7.807 a | 6.343 bc | 5.270 cdef | 8.067 a | 6.204 a |
| 60 Days | 2.843 hi | 3.413 ghi | 5.870 bcd | 5.023 def | 4.030 fgh | 6.870 ab | 4.675 b |
| 75 Days | 1.508 j | 2.280 ij | 4.040 fgh | 3.157 ghi | 2.713 ij | 4.783 def | 3.080 c |
| Mean | 2.909 d | 3.684 c | 5.905 a | 4.841 b | 4.004 c | 6.573 a | |

* Different alphabets in the same column show significant difference using Duncan's Multiple Range test (P≤ 0.05)

The results of the tables (3,4,5,6 and 8) indicate the superiority of seedlings grown at 45 days of age in the content of leaves from the element phosphorous and potassium, the percentage of total dissolved solids (TSS) in the knob, the percentage of vitamin C in the knob and the content of the knob from carbohydrates. But there were no differences significant differences between seedlings grown at 45 and 60 days of age in the percentage of nitrogen in the leaves as shown in Table (2), and there were no significant differences between seedlings at the age of 45, 60 and 75 days in the percentage of acidity in the knob as shown in Table (7). This may be due to the fact that

young seedlings have passed the shock of transplantation faster than big seedlings, and the speed of root renewal and cell division and growth faster (McKee, 1981), which led to the formation of a large root system and consequently the increased absorption of water and nutrients from the soil and an increase in its content in the leaves, which positively reflected on the vegetative growth and the conduct of physiological processes inside the leaves, which led to the improvement of qualitative characteristics. The results show the superiority of the fertilizer combination of NPK 120:90:50 kg $ha^{-1}$ in all qualitative characteristics. This may be due to the role of nutrients, especially nitrogen, which has a role in the photosynthesis process whereby nutrients are converted to carbohydrates and resulting from the conversion of light energy into chemical energy (Mohammed, 1985). Likewise, potassium transforms and moves carbohydrates, as its deficiency leads to the difficulty of moving carbohydrates because it stimulates the activity of enzymatic systems that are related to the process of manufacturing and converting carbohydrates to the knob (Ishaq and Ibrahim, 1984). Similar results have been reported by Nagar (2016) that found the fertilizer combination of NPK 100:60:50 was significantly superior in the content of vitamin C in knob 44.13 mg 100 $g^{-1}$ and an increase in the content of total dissolved solids (TSS) 7.22 Brix. While the fertilizer combination of NPK 60:45:50 gave lowest vitamin C 36.48mg $100g^{-1}$ and total soluble solids (TSS) 6.42 Birx

## CONCLUSION

The study showed that the seedlings age promoted qualatitive of kohlrabi. the plants cultivated in seedlings age 45 days performed better in tthe percentages of nitrogen in the leaves, phosphorus and potassium, total dissolved solids (TSS) in knob, content of vitamin C in knob, acidity in the knob and carbohydrates in the knob, compared to seedlings age 75 days. With regard the fertilizers combination of NPK, using combination fertilizer of NPK at level 120:90:50 kg ha-1, showed improvement in all the studied quality characteristics. In addition, the application of seedling age 45 days and combination fertilizer of NPK at 120:90:50 kg $ha^{-1}$ increased the all quality characteristics except the percentage of nitrogen in leaves. Whereas, seedling age 60 days and combination fertilizer of NPK at 120:90:50 kg $ha^{-1}$ recorded the highest value in the percentage of nitrogen in leaves.

## CONFLICT OF INTEREST

The authors declare no conflicts of interest associated with this manuscript.

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