****

**Response of Basil (*Ocimum Basilicum* L.) Growth Analysis to Sowing Date and Cutting Time**

Research Project

Submitted to the department of (Field Crops and Medicinal Plants) in partial fulfillment of the requirements for the degree of BSc. in Field Crops

***By*:**

***Hiwa Haydar Muhammad***

***Dastan Fkri Fakhir***

***Supervised by***

***Dr. Aryan Suad Ahmad Dizayee***

**April-2023**

**List of Contents**

**Abstract………………………………………………………………… 1**

**1. Introduction………………………………………………………….. 1**

**2. Materials and Methods……………………………………………… 2**

**2.1. Measurement growth and growth Indices ………………………. 3**

**2.2.1. Plant height (cm)………………………………………………… 3**

**2.1.2. Number of leaves per plant……………………………………... 3**

**2.1.3. Leaf area (LA)…………………………………………………… 3**

**2.1.4. Leaf Area Index (LAI)…………………………………………... 3**

**3. Results and Discussion………………………………………………. 3**

**3.1. Measurement Growth and Growth Indices…………………….... 3**

**3.1.1. Plant height (cm)……………………………………………….... 3**

**3.1.2. Number of leaves per plant……………………………………... 4**

**3.1.3. Leaf Area (LA)………………………………………………….... 5**

**3.1.4. Leaf Area Index (LAI)………………………………………...… 6**

**4. Conclusion…………………………………………………………..... 6**

**References………………………………………………………………. 7**

**List of Figure**

|  |  |
| --- | --- |
| **Figure Name** | **Page No.** |
| 3.1.1. Effect sowing date × cutting time on plant height (cm) of basil crop. | 4 |
| 3.1.2. Effect sowing date × cutting time on number of leaves per plant of basil crop. | 5 |
| 3.1.3. Effect sowing date × cutting time on leaf area (LA) of basil crop. | 5 |
| 3.1.4. Effect sowing date × cutting time on leaf area (LAI) of basil crop. | 6 |

**A B S T R A C T**

The study was conducted at College of Agricultural Engineering Sciences during the winter season 2022 - 2023 to investigate the influence sowing date and time of cutting on growth indices in basil plants (*Ocimum basilicum* L.). The experiments were carried out using pots with a depth of 18 cm and a diameter of 18 cm. The pots were filled with a sieved soil. Initially, the seeds were planted densely, but later thinned to fifteen plants per pot, replicated three times resulting in 12 experimental units. The growth and growth indices of basil can be influenced by several factors, including sowing date and cutting time.The highest mean value of plant height was reached at interaction first sowing date with second cutting time, their mean value was (9.33 cm). As for number of leaves per plant the higher mean value was (6.0) obtained at interaction first sowing date with second cutting time. The maximum mean value of leaf area (LA) was reached at interaction first sowing date with second cutting time their mean value (4.79). The maximum mean value of leaf area index (1.20) was recorded at interaction first sowing date with second cutting time. It is important for growers to consider date of sowing and time of cutting when managing the growth and development of basil plants. Understanding the ideal timing for these factors can result in higher yields and better quality plants.

**KEY WORDS:** Basil, Growth indices, Sowing date, Cutting time.

**1. INTRODUCTION**

Basil plant (*Ocimum basilicum* L.) is a popular culinary herb that is valued for its distinct aroma and flavor of the family Lamiaceae used for its leaves (Tucker and DeBaggio, 2009). Plants can reach heights of between 30 and 150 cm, its leaves are richly green and ovate, leaf sizes range from 3 to 11 cm long, and between 1 and 6 cm wide (Vanitha *et al*., 2021). In general, basil is widely adapted and grown throughout the globe. Although basil grows best outdoors, it can be grown indoors in a pot and, like most herbs, A greenhouse or row cover is ideal if available (Marondedze *et al*., 2018). Several factors influence the growth and development of plants, and the primary determinant of plant development is temperature (Kumar *et al*., 2014). The optimum temperature for basil growth is in the range of 25 and 30, while the minimum temperature at which basil can survive is 10.9 C˚ (Hiltunin and Holm 1999). Basil plants require regular watering, but not as much attention as is needed in other climates (Roberts *et al*., 2009). Growth analysis can be used to account for growth in terms that have functional or structural significance, the type of growth analysis requires measurement of plant biomass and assimilatory area (leaf area) and methods of computing certain parameters that describe growth (Radford, 1967). The growth and yield of basil (*Ocimum basilicum* L.) can be influenced by several factors, including sowing date and cutting time. The sowing date of basil is crucial for optimal growth and yield. Similarly, sowing basil at the right time and harvesting it at the right time can result in better growth indices, including faster growth, higher yields, and better quality. Therefore, it is important to understand the ideal sowing date for basil to maximize its growth and yield potential (Abu-zahra *et al*., 2014). The cutting time of basil is also critical for optimal growth and yield. Basil is a fast-growing herb that can be harvested multiple times during the growing season. However, the timing of the harvest is essential to ensure that the plant produces flavorful and aromatic leaves. Several studies have been conducted on the growth indices of basil in relation to sowing date and cutting time. For example, a study by (El-Sayed *et al*., 2014) investigated the effect of sowing date on the growth, yield, and quality of sweet basil. The study found that sowing sweet basil in early April resulted in higher plant height, fresh and dry weight, and oil content compared to sowing in mid-May or late May. Similarly, a study by (Ozguven *et al*., 2020) examined the effect of cutting time on the growth and yield of sweet basil. The study found that harvesting sweet basil at 45 and 60 days after sowing resulted in higher yields and better quality compared to harvesting at 30 days after sowing (Roberts *et al*., 2009 and Sims *et al*., 2014). The main objective of this study is to determine effect of two sowing date and two cutting time on growth and growth indices of two basil varieties.

**2. MATERIALS AND METHODS**

The study was conducted at College of Agricultural Engineering Sciences during the winter season 2022 - 2023 to determine effect of sowing date and time of cutting on some parameters of growth and growth indices in basil plant (*Ocimum basilicum* L.). The experiments were carried out using pots with a depth of 18 cm and a diameter of 18 cm. The pots were filled with a sieved soil. Initially, the seeds were planted densely, but later thinned to twenty plants per pot, replicated three times resulting in 12 experimental units. The seeds were sowed after the pots had been thoroughly irrigated. As for first and second sowing date seeds were sown at 1 and 12 February 2023, thirty-six days after sowing (36 DAS) the first cutting was done, after that the second cutting done after ten days of first cutting (10 DAC), were randomly five samples collected from each pot to measuring plant height, number of leaves, leaf area (LA) and leaf area index (LAI). For a 5% level of significant, data are shown by error bars with standard errors identified with (Duncan, 1975) letters.

**2.1. Measurement Growth and Growth Indices**

**2.1.1.** Plant height (cm)

**2.1.2.** Number of leaves per plant

**2.1.3.** Leaf area (LA)

**2.1.4.** Leaf area index (LAI) =

**3. RESULT AND DISCUSSION**

**3.1. Measurement growth and growth indices**

**3.1.1. Plant height (cm)**

The sowing date and timing of cutting can affect plant height, branching, and the yield of basil. Statistical analysis figure (3.1) shows that there were highly significant effects (P ≤ 0.05) between interaction sowing date × cutting time on plant height (cm) of basil crop (*Ocimum basilicum* L.). The highest mean value of plant height was reached at interaction first sowing date with second cutting time, while the lowest mean value of this traits reached at interaction second sowing date with first cutting time, their mean values were (9.33 and 7.16 cm) respectively. According to a study conducted by (El-Sayed *et al*., 2016 and Khaledi *et al*., 2017) showed that early sowing (February) resulted in significantly taller plants compared to late sowing (March). The reason for the effect of sowing date on plant height could be due to the temperature and light conditions during the growing period and the highest plant height was obtained when cutting was done at the flowering stage, followed by the vegetative stage and then the budding stage.

**Fig. 3.1** Effect sowing date × cutting time on plant height (cm) of basil crop.

**3.1.2. Number of leaves per plant**

The number of leaves per plant is an important yield component in basil production. Data analysis as shown figure (3.2) exhibits that there were highly significant differences (P ≤ 0.05) on number of leaves per plant. The higher mean value of this trait (6.0) was obtained at interaction first sowing date with second cutting time, whereas the lowest mean value (4.0) was obtained at interaction second sowing date with first cutting time respectively. Sowing date and cutting time has a significant effect on the number of leaves per plant in basil crop. A study conducted by (Gill and Randhawa, 1997) showed that early sowing date and cutting done at the vegetative stage resulted in a higher number of leaves per plant compared to late sowing.

**Fig. 3.2** Effect sowing date × cutting time on number of leaves per plant of basil crop.

**3.1.3. Leaf Area (LA)**

Sowing date has a significant effect on leaf area of basil crop. Figure (3.3) revealed that there were highly significant effects (P ≤ 0.05) between interaction sowing date × cutting time leaf area (LA) of basil crop (*Ocimum basilicum* L.). The maximum and minimum mean value was reached at interaction first sowing date with second cutting time and first sowing date with first cutting time with their mean values (4.79 and 0.42) of respectively. El-Sayed *et al*., (2016) showed that early sowing resulted in a higher leaf area and leaf area index compared to late sowing. Similarly, Abu-Zahra *et al*. (2014) reported that early sowing (December) resulted in a higher leaf area and leaf area index compared to late sowing (February).

**Fig. 3.3** Effect sowing date × cutting time on leaf area (LA) of basil crop.

**3.1.4. Leaf Area Index (LAI)**

Timing of cutting has a significant effect on leaf area index of basil crop. Analysis of variance figure (3.4) showed that there were highly significant differences (P ≤ 0.05) on leaf area index (LAI). The highest mean value of leaf area index (1.20) was recorded at interaction first sowing date with second cutting time, whereas the lowest mean value (0.11) was recorded at interaction first sowing date with first cutting time respectively. Cutting at the vegetative stage may promote the growth of axillary buds, resulting in more leaves and ultimately a higher leaf area and leaf area index. Additionally, cutting at the flowering stage may reduce the vegetative growth of the plant and redirect the energy towards reproductive growth, resulting in a lower leaf area and leaf area index (Chang *et al*., 2005).

**Fig. 3.4** Effect sowing date × cutting time on leaf area index (LAI) of basil crop.

**4. CONCLUSION**

In conclusion, the growth indices of basil can be influenced by sowing date and cutting time. It is important for growers to consider these factors when managing the growth and development of basil plants. Understanding the ideal timing for these factors can result in higher yields and better quality plants. Further research is needed to explore the optimal sowing and cutting practices for different basil varieties and growing conditions.

**REFERENCES**

ABU-ZAHRA, T. R., Al-AJLOUNI, M. M., & Al-SARAIREH, Y. M. 2014. Effect of sowing dates on growth, yield and chemical constituents of basil (*Ocimum basilicum* L.). Journal of Agricultural Science and Technology, 16, 1609-1622.

CHANG, X., ALDERSON, P. and WRIGHT, C. 2005. Effect of temperature integration on the growth and volatile oil content of basil (*Ocimum basilicum* L.). *The Journal of Horticultural Science and Biotechnology*, *80*(5), pp.593-598.

DUNCAN, D.B. 1997. T tests and intervals for comparisons suggested by the data. Biometrics, pp.339-359.

EL-SAYED, H. S., AHMED, N. A., & HUSSEIN, M. S. 2016. Effect of sowing date and plant density on yield and quality of basil (*Ocimum basilicum* L.). Journal of Horticultural Science and Ornamental Plants, 8(1), 36-43.

EL-SAYED, S. A., GADALLAH, M. G. E., & SHADDAD, M. A. K. 2014. The effect of sowing date and plant density on sweet basil (*Ocimum basilicum* L.) growth, yield and oil content. Annals of Agricultural Sciences, 59(1), 39-45.

GILL, B.S. and RANDHAWA, G.S. 1997. Effect of different transplanting dates and harvesting stages on the quality of French basil oil. *Journal of herbs, spices & medicinal plants*, *4*(3), pp.35-42.

HILTUNEN, R.; HOLM, Y. 1999. Essential of oil of Ocimum. In Basil: The Genus Ocimum; Hiltunen, R., Holm, Y., Eds.; Harwood Academic Publishers: Amsterdam, The Netherlands, pp. 113–135.

KHALEDI, M., BOSKABADY, M. H., ESLAMIZAD, M., KIANI, S., & AMIR-AHMADI, M. 2017. Effect of harvesting time on yield, essential oil content and composition of basil (*Ocimum basilicum* L.) under different levels of nitrogen fertilizer. Industrial Crops and Products, 105, 120-127.

KUMAR, B.; GUPTA, E.; YADAV, R.; SINAGH, S.C.; LAL, R.K. 2014. Temperature effects on seed germination potential of holy basil (*Ocimum tenuiflorum*). Seed Technol. 36, 75–79.

MARONDEDZE, C., LIU, X., HUANG, S., WONG, C., ZHOU, X., PAN, X., An, H., XU, N., TIAN, X. and WONG, A. 2018. Towards a tailored indoor horticulture: A functional genomics guided phenotypic approach. Horticulture research, 5.

OZGUVEN, A. I., TUNCEL, G., & KUSCU, H. 2020. Effects of different cutting times on growth and yield of sweet basil (*Ocimum basilicum* L.). Journal of Agricultural Faculty of Gaziosmanpasa University, 37(1), 41-48.

RADFORD, P.J. 1967. Growth Analysis Formulae- Their Use and Abuse 1. Crop science 7(3), pp. 171-175.

ROBERTS, P.D., RAID, R.N., HARMON, P.F., JORDAN, S.A. and PALMATEER, A.J., 2009. First report of downy mildew caused by a Peronospora sp. on basil in Florida and the United States. Plant Disease, 93(2), pp.199-199.

SIMS, C.A., JULIANI, H.R., MENTREDDY, S.R. and SIMON, J.E. 2014. Essential oils in holy basil (*Ocimum tenuiflorum* L.) as influenced by planting dates and harvest times in North Alabama. *Journal of Medicinally Active Plants*, *2*(3), pp.33-41.

TUCKER, A.O. AND T. DEBAGGIO. 2009. The encyclopedia of herbs: A comprehensive reference to herbs of flavor and fragrance. Timber Press, Portland.

VANITHA, G., MANIKANDAN, R., PRAGASAM, A., SATHIYAMOORTHI, K. and DHINAKARAN, B. 2021. Eco-Friendly Synthesis of some Novel Metal Nanoparticles Mediated by *Ocimum Basilicum*-Lamiaceae (Thiru Neetru Pathilai) Leaves Extract. IJRASET, 9, pp.548-561.