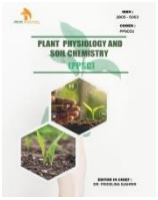
ZIBELINE INTERNATIONAL™ PUBLISHING

ISSN: 2805-5063 (Online)
CODEN: PPSCCU

Plant Physiology and Soil Chemistry (PPSC)

DOI: http://doi.org/10.26480/ppsc.02.2024.133.136



RESEARCH ARTICLE

EFFECT OF WEEDING FREQUENCY AND FERTILIZER APPLICATION RATES ON THE GROWTH AND YIELD OF CARROT *(Daucus Carota L.)* IN IGBARIAM

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ARTICLE DETAILS

Article History:

Received 20 September 2024
Received 02 November 2024
Accepted 14 November 2024
Available online 05 December 2024

ABSTRACT

Weeds are one of the major problems in crop production systems around the world with devastating consequences. Thus, suitable plant spacing and effective weeding regime is very important in the management of the competition between carrot and weeds at critical growth stages of the crop. The experiment was conducted at Igbariam to determine the effect of weeding frequency and fertilizer application rates on the growth and yield of carrot *(Daucus carota* L.) in 2022 and 2023 cropping season. It was laid out in a 3x3 factorial experiment in a randomized complete block design (RCBD) with three replications. The selected weeding frequencies (zero weeding, weeding twice and weeding thrice) were the main factor while the three plant spacing (0, 200 and 400 NPK 15:15:15 kg/ha) consisted of the sub-factor. Data collected were subjected to analysis of variance (ANOVA) and significant mean were separated using Fisher's Least Significant Difference (LSD). The tallest Plant height (12.0 cm) and number of leaves (52cm) in 2022 were obtained in the plots of twice weeding frequency while fertilizer rate of 400kg/ha had the best fresh weight effect (140 kg/ha) followed by 200kg/ha (130kg/ha).

KEYWORDS

Weed frequency, carrot, fertilizer, growth and yield.

1. INTRODUCTION

Carrot (Daucus carota L.) from the family Apiaceae is a biennial vegetable crop, cultivated worldwide for its roots. Carrots of many colors provide important nutrient and phytochemicals that act as a functional food. The storage root due to its richness in carotenoids, anthocyanins, dietary fiber, minerals and antioxidants are becoming more popular and valuable (Arscott and Tanu- mihardjo, 2010). Carrot is also rich in hydrophilic phenol antioxidants which are known for a wide range of health promoting properties such as anticancer, anti-atherogenic, anti-inflammatory, and antimicrobial (Grassmann et al., 2007). Weeds are regarded as one of the major problems in crop production around the world; especially in the tropics. They can compete with productive crops or convert productive land into unusable scrub (Colquhoun et al. 2020). They are often poisonous, distasteful, harmful and consequently interfere with the use and management of desirable plants by significantly reducing crop yield as well as contaminate harvests. They compete with crop for space, nutrients, water and light (Ngonadi et al., 2023; Nath et al., 2024). Research related to crop production systems now aimed at establishing the ideal or best agronomic practices (Mohammed and Mohamed, 2009; Haarhoff and Swanepoel, 2022).

Wrong methods of fertilizer application rates can consequently lead to soil toxicity, crop burn and decline in crop yield. Carrot removes appreciable quantities of plant nutrients from the soil, hence incorporation of considerable amount of organic manure or inorganic fertilizer during planting is recommended to maintain soil productivity. Selection of good cultivars or varieties is good steps toward maximumum production alongside proper soil management are keys to sustainable agriculture (Simmons and Natziger, 2010).

2. MATERIALS AND METHODS

The experiment was conducted at the Research Farm of National Root Crop Research Institute, Sub Station Igbariam in two cropping season. It lies between latitude 15° 72°N and longitude12° 38°E and altitude 140m above sea level. The experiment was 3x3 factorial laid out in a randomized complete block design (RCBD) with three replications. The selected weeding frequencies (zero weeding, weeding twice and weeding thrice) consisted of the main factor while three the plant spacing (0, 200 and 400 NPK 15:15:15 kg/ha) represented the sub-factor. The weeding methods used were hoeing and hand pulling. The twice weeding frequency was carried out at 3rd and 6th weeks and thrice weeding frequency was carried out at 3rd, 6th and 9th week. The NPK fertilizer was applied twice (4 and 8 weeks after sowing) using band placement. The experimental site was properly ploughed (20-30 cm) deep, harrowed and seedbeds made in order to enhance effective germination and root penetration, a fine seedbed of (3x2m) in size was prepared before sowing. Sowing was done at the depth of 2cm, two seeds per hole on a well prepared fine soft bed as a result of proper tillage. Carrot seeds were sourced from Jennicalis agro seed company Awka, clean, disease-free and viable seeds were planted with the selected plant spacing.

3. DATA COLLECTION

3.1 Growth Parameters

Plant height (cm): This was measured with a metre rule from the base of the stem at soil level to the terminal bud of the main stem at weekly intervals from 30-90 days after planting.

Number of leaves: The number of leaves produced per carrot plant was counted and the mean value recorded. This was done at weekly intervals.

Quick Response Code	Access this article online	
	Website: www.ppsc.org.my	**DOI:** 10.26480/ppsc.02.2024.133.136

Cite The Article: Ngonadi, E.N. (2024). Effect of Weeding Frequency and Fertilizer Application Rates on the Growth and Yield of Carrot *(Daucus Carota L.)* in Igbariam. *Plant Physiology And Soil Chemistry, 4 (2): 133-136.*

3.2 Yield parameters

Length of root per plant (cm): Four selected and tagged plants were uprooted and detached from the foliage part. Then the length of modified roots was measured by rule and recorded.

Fresh weight of the carrot (g): At harvest the carrots per plot were weighed after counting using a weighing scale and the weights were recorded.

4. Data Analysis

Data collected was subjected to analysis of variance (ANOVA) using Gen-stat Release 10.3 statistical package 4th Edition, while the means were separated using the Fisher Least Significant Difference (LSD) at 5% probability level.

5. Result

Table 1: Effect of weeding frequency and fertilizer rates of carrot on plant height at 4, 8, 10 weeks after planting (WAP) at Igbariam in 2022 and 2023 cropping season.

Treatments	Plant height in 2022				Plant height in 2023		
Weeding frequency	4WAP	8WAP	10WAP		4WAP	8WAP	10WAP
Zero weeding	8.0	8.3	12.0		7.8	9.0	12.3
Twice weeding	10.6	11.4	14.1		9.5	10.5	13.0
Thrice weeding	10.0	11.6	13.2		10.8	11.7	11.8
Mean	9.5	10.4	13.1		9.4	10.4	12.4
LSD	0.5	0.3	0.4		0.5	0.3	0.5
Fertilizer rates (kg/ha)							
0	9.3	18.1	20.0		9.0	18.0	19.0
200	11.2	21.3	23.3		11.3	21.6	23.4
400	10.3	19.0	21.2		10.5	19.2	21.2
Mean	10.2	19.4	21.5		10.1	19.6	21.2
LSD	0.3	0.4	0.4		0.3	0.4	0.3
Interaction							
WF x FR	NS	NS	NS		NS	NS	NS

Table 2: Effect of weeding frequency and fertilizer rates of carrot on number of leaves per plant at 4, 8, 10 weeks after planting (WAP) at Igbariam in 2022 and 2023 cropping season

Treatments	Number of leaves in 2022				Number of leaves in 2023		
Weeding frequency	4WAP	8WAP	10WAP		4WAP	8WAP	10WAP
Zero weeding	13.0	25.4	33.1		12.0	23.4	32.1
Twice weeding	25.3	36.2	50.0		22.3	35.2	52.0
Thrice weeding	23.2	30.1	42.4		22.2	29.1	40.4
Mean	20.4	30.5	41.8		18.8	29.2	41.5
LSD	1.0	1.2	1.5		1.5	1.6	1.9
Fertilizer rates (kg/ha)							
0	15.0	50.1	67.4		14.0	45.4	64.2
200	27.1	61.0	94.1		28.6	57.9	90.2
400	23.4	54.0	86.0		24.4	50.0	84.6
Mean	21.8	55.0	82.5		22.3	51.1	76.6
LSD	1.8	1.6	2.0		1.5	1.7	2.0
Interaction							
WF x FR	NS	NS	NS		NS	NS	NS

Table 3: Effect of weeding frequency and fertilizer rates of carrot on length of roots (cm) at 10 weeks after planting (WAP) at Igbariam in 2022 and 2023 cropping season.

Treatments Weeding frequency	Length of roots (cm) at 10 WAP		
	2022		2023
Zero weeding	11.0		10.0
Twice weeding	13.0		15.0
Thrice weeding	16.1		12.1
Mean	13.3		12.3
LSD	2.0		2.0
Fertilizer rates (kg/ha)			
0	11.1		9.0
200	17.0		16.2
400	13.0		12.0
Mean	13.6		12.3
LSD	2.0		2.0
Interaction			
WF x FR	1.3		1.4

Table 4: Effect of weeding frequency nd fertilizer rates of carrot on fresh weights of root (g) at 4, 8, 10 weeks after planting (WAP) at Igbariam in 2022 and 2023 cropping season.

Treatments	Fresh weight of roots (kg) at 10 WAP		
Weeding frequency	2022		2023
Zero weeding	106		100
Twice weeding	110		112
Thrice weeding	140		130
Mean	120		114
LSD	5.0		5.0
Fertilizer rates (kg/ha)			
0	121		120
200	130		125
400	143		145
Mean	131.3		130
LSD	10		10
Interaction			
WF x FR	2.6		2.7

6. Discussion

6.1 Plant Height

Table1 showed the result on growth parameter, plant height among the weeding frequencies. The result obtained indicated that weed frequencies were significantly different at 4WAP, 8WAP and 10WAP. Weeding twice recorded the tallest plant height both at 4WAP, 8WAP and 10WAP in both cropping seasons. The shortest plant height was recorded in zero weeding frequency as (7.8cm, 8.3cm and 12.0cm) at 4WAP, 8WAP and 10WAP in 2022 and 2023. The fertilizer rate with the tallest plant height was recorded in 200kg/ha treated plots as (11.3cm, 21.6cm and 23.4cm) at 4WAP, 8WAP and 10WAP in 2022. The shortest plant height was recorded in zero kg/ha treatrd plots (9.0cm, 18.0cm and 19.0cm) in 2022. The analysis of variance showed that the interaction between weeding frequency and fertilizer rates was not significant.

6.2 Number of Leaves Per Plant

Table 2 showed the result on number of leaves. The weeding frequencies were significantly different at 4WAP, 8WAP and 10WAP. Weeding twice recorded the highest number of leaves both at 4WAP, 8WAP and 10WAP as (22.3 cm, 35.2 cm, 52.0 cm) in 2022 cropping season. The lowest number of leaves was recorded in zero weeding frequency as (12.0cm, 23.4cm and 32.1cm) at 4WAP, 8WAP and 10WAP in 2023. The fertilizer rate with the highestt number of leaves was recorded in 200kg/ha treated plots as (27.1 cm, 61.0 cm and 94.1 cm) at 4WAP, 8WAP and 10WAP in 2022 cropping season. The lowest number of leaves was recorded in zero kg/ha spaced plots (14.0cm, 45.4cm and 64.2cm) in 2023 cropping season. The analysis of variance showed that the interaction between weeding frequency and fertilizer rates was not significant.

6.3 Length of Root Per Plant (cm):

Table3 showed the result on length of carrot root. The weeding frequency was significantly different at 10 WAP. Weeding thrice recorded the longest root length as (16.1 cm) at 10WAP in 2022 cropping season. The shortest root length was recorded in zero weeding frequency as (10.0 cm) at 10WAP in 2023. The fertilizer rate with the longest root length was recorded in 200kg/ha applied plots (17.0cm) at 10WAP in 2022 cropping season. The shortest root length was recorded in zero kg/ha applied plots (9.0cm) in 2023. The analysis of variance showed that the interaction between weeding frequency and fertilizer rates was significant (P>0.05).

6.4 Fresh Weight of Carrot

The result on fresh weight of carrot is presented in Table 4. The result obtained showed, that weeding frequency was significantly different at 10WAP. Weeding thrice recorded the highest fresh weight as (140kg/ha) at 10WAP in 2022 cropping season. The lowest fresh weight was recorded in zero weeding frequency as (100 kg/ha) at 10WAP in 2023. The fertilizer rate with the highest number fresh weight was recorded under 400kg/ha plots as (145 kg/ha) at 10WAP in 2023 cropping season. The lowest fresh weight was recorded in zero kg/ha treated plots as (120 kg/ha) in 2023 cropping season. The analysis of variance showed that the interaction between weeding frequency and fertilizer rates was significant (P>0.05).

7. CONCLUSION

The effect of fertilizer rates on carrot production was significant. Fertilizer application affected the size, shape, and yield of the crop. Generally, zero fertilizer rate led to smaller, thinner carrots with lower yields, while NPK fertilizer rate at 200kg/ha results in larger, thicker carrots with higher yields (Uwah, et al., 2013). Several studies have investigated the effect of weeding frequency on carrot production. One study conducted in Iran found that weeding at 14days intervals resulted in significantly higher carrot yields compared to weeding at 30days intervals. The researchers attributed this increase in yield to the reduction in weed competition and the improved utilization of soil nutrients and water by the plants. Another study conducted in Nigeria found that frequent weeding (every 2 weeks) significantly increased carrot yield compared to weeding at 4-weeks intervals. In addition, the researchers noted that frequent weeding resulted in a lower incidence of pest and disease damage (Harrison et al., 2014).

Recommendation

The research on the effect of weeding frequency and fertilizer rates on the growth and yield of carrot showed that application of NPK 15:15:15 at 200kg/ha and weeding twice improved the vegetative growth, weeding frequency of thrice reduced competition drastically for soil moisture, nutrient elements at 10WAP which leads to higher carrot fresh weight. Farmers should adopt the use of NPK 200kg/ha and thrice weeding to achieve maximum carrot yield.

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