EFFECT OF DIFFERENT LEVELS OF NITROGEN AND CHICKEN MANURE ON GROWTH AND OIL CONTENT OF SPEARMINT (Mentha Spicata L.*)*

By

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DEDICATION

This Work is dedicated

to my husband (Moneim),

to my Son (Osman) and

to my expected child

With endless love for live

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ABSTRACT

This experiment was conducted in Faculty of Agriculture nursery, at Shambat to study the effect of nitrogen and chicken manure fertilization on herbage yield and oil content of the spearmint (*mentha spicata*) during the season 2005-2006. Six treatments were used in this study, 2N, 4N nitrogen in the form of urea, 2.5, 5 tons/fed chicken manure and 2N nitrogen+2.5 ton/fed chicken manure and a control.

The results show that, there were no significant differences among the different treatments on the growth parameters and oil content. On the other hand the results show a significant difference among the different treatments on the fresh and dry weight of shoots and the roots.

Also the results show that the higher fresh weight was at the 2N treatment (274.97 g) while the lower fresh weight in the 4N treatment (113.93 g). Higher dry weight was in the 2N treatment (62.7 g) and the lower dry weight in 2N nitrogen+2.5 ton/fed chicken manure (32.17 g), also higher root weight was in 2N treatment (132.433 g) and the lower root weight in 4N treatment 107.10 grams.

بسم الله الرحمن الرحيم

<u>ملخص الأطروحة</u>

أجريت هذه التجربة فى مشتل كلية الزراعة ، جامعة الخرطـوم بـشمبات بغـرض متابعة أثر السماد النايتروجينى ومخلفات الدواجن على إنتاج العشب وكمية الزيت فى نبـات النعناع البلـدى (*Mentha Spicata L.*) خـلال موسـم 2005-2006 اسـتعملت 6 معاملات : 2N، 4N نيتروجين/فدان فى صورة يوريا ، 2.5، 5 طن للفدان مخلفات دواجن و N2 نيتروجين+ 2.5 طن للفدان مخلفات دواجن والشاهد.

أوضحت النتائج انه ليس هنالك فروقات معنوية بين مختلف المعاملات على مقاييس فى طول النبات وعدد الأوراق وعدد الفروع وطول الجذور والمحتوى الرطوبى لكـل مـن الفروع والجذور وفى كمية الزيت.

ومن الناحية الأخرى أوضحت النتائج وجود فروقات معنوية بين المعاملات المختلفة فى وزن العشب الطازج والجاف ووزن الجذور.

أيضا توضح النتائج ان أعلى معاملة فى إنتاج العشب الطازج كانت فى معاملـة 2N حيث أعطت 274.97 جرام واقل معاملة 4N حيث أعطت 113.93 جرام و أعلى معاملـة فى إنتاج العشب الجاف 2N 62.7 جرام واقل معاملة 2.5 طن للفدان مخلفات دواجن+2N نيتروجين (32.17 جرام)، أيضاً كانت أعلى إنتاجية فى وزن الجـذور فـى معاملـة 2N (433.32 جرام) واقل معاملة 4N (107.10 جرام).

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CHAPTER ONE

INTRODUCTION

The history of herbal medicine is as old as human history. In the continent of Africa, the application of herbs for internal and external uses has always been a major factor in the practice of medicine. The treatment of wounds with concoctions prepared from leaves, bark, and a root is a daily occurrence (Ayensu, 1978).

The knowledge of medicinal plants is normally passed on orally from one generation to the next. But a lot of valuable information can be lost or distorted when ever a medicine man dies without revealing his knowledge to another (Kokwaro, 1976).

Medicinal and aromatic plants have various uses. Some of them are used as condiments for flavouring food as black cumin, some are used in folk medicine and other used in perfumes as jasmine, others are used in cosmetics as chamomile and insecticides as neim (Hussian, 1981).

Medicinal plants are easily available, less expensive and people believe in them particularly in rural areas whereas synthetic chemical drugs are limited. All these factors increased the desire of large sectors of the population to use medicinal plants (Karl, *et al.*1997).

In the Sudan medicinal plants may play an important role in the agricultural and economic development as Sudan has different climatic zones, which can serve large potential sources for medicinal and aromatic plants.

In this study we dealt with one of the species of the family labiatae, which include many important medicinal and aromatic species belonging to *genus mentha*. One of these species is *Menth spicata* L, common locally knows as "Na'na'".

In the Sudan the spearmint was grown for the local market in limited area of about 25 feddan in Khartoum North (Hilat KuKu). Bashir (2000).

The objective of this study was to investigate the effect of fertilization with urea and chicken manure on growth and oil content of *Mentha spicata* L.

CHAPTER TWO

LITERATURE REVIEW

2.1 Botany of the plant:

2.1.1 Family labiatae:

Most of the species of the family labiatae are aromatic, herbaceous annulus or perennials, while some tropical species are trees (Rizk, 1986).

The family labiatae includes 200 genera and about 3300 species (Abdelaziz and Hamad, 1988). Which are distributed over almost all the temperate and tropical regions. The family is well represented in Mediterranean area and Britain (Gerhenzonm, J. *et al*. 1989). Many members of this family are used as culinary or in medicinal purposes.

2.1.2 The genus mentha:

The genus mentha is one of the 200 genere of the family labiatae. It is a perennial herb, including about 25 species with 2000 to 3000 varieties being obtained by hybridization (Foster, 1984). The famous species of this genus are *mentha sylvestris* (the horse mint), *menthe spicata* L (Spear mint), *mentha arvensis* (Japanese mint) and *mentha piperita* L. (Pepper mint) (Guenther, 1949).

2.1.3 Species and varieties:

The nomenclature of the plant from which the different commercial spearmint oils are distilled is complicated and confusing; the vernacular term “spearmint” comprises a number of types possessing the well known odor and flavor of this popular mint. The United States and Great Britain raise several varieties of *mentha spicata* Huds. (*M. viridis* L), e.g. M. *spicata Huds*. Var. tenuis (michx.) Briq in North America and M. spicatce Huds. Var. trichoura Briq in England.

M. Spicata Huds. Var crispata (schrad.) Briq is cultivated in Germany. (Guenther, 1949).

2.1.4 General morphology of spear mint:

The general morphology of spearmint is that the squared and light green stem stands more erect with numerous lateral branches at the leaf axils. Some aerial branches; runners; spread along soil surface forming roots at nodes, and the apical part of the branch changed into rhizome-like root stock when enter the soil. The leaves are lance-shaped, longer, narrower, lighter green in colour with very short petiole. The flowering spikes are more sharply pointed, long and narrow; hence the designation spearmint. The root stock are creamy-thick and juicy spread horizontally below the soil surface (Salim, 1997).

2.2 Medicinal action and uses of the plant:

Spearmint is chiefly used for culinary purposes. It is also used as stimulant, carminative and antispasmodic. It is better adapted for children's maladies. Spearmint oil is added to many compounds on account of its carminative properties because its taste is pleasant. A distilled water of spearmint relieves hiccough and flatulence as well as in digestion. For infantile trouble generally, the sweetened infusion is an excellent remedy, and is also a pleasant beverage in fevers, in flammatory diseases. It is useful in allaying nausea and vomiting and in relieving the pain of colic, and as a local application in painful haemorrhoids. Its principal employment is for its febrifuge and diuretic virtues. (Grieve, 1970).

Infusion of *mentha spicata* leaves is refreshing carminative, stomachic, aphrodisiac, odontalgic, appetizer, especially when mixed with tea, mixed with vinegar and indigo it from an emetic (Boules, 1983).

2.3 Chemical constituent of spearmint:

Earliest investigations on the chemistry of spearmint oil date back more than a century (Guenther, 1949). The chief constituent of spearmint oil is carvone, there are also present phellandrine, limonene and dihydrocarveol acetate. Esters of acetic, butyric and caproic or caprylic acids are also present (Grieve, 1970 and Guenther, 1949).

Trease and Evan (1989) mentioned that carvone and limone are divergently formed from a common intermediate.

Presence of vitamins such as vitamin A, riboflavin, and vitamin C is also reported in species of *genus mentha*.

Madzharova *et al*., (1979) found that a hybrid obtained by crossing *menth spicata* L. and *mentha viridis* contains 43 mg of vitamin C / 100g.

Spearmint is rich of in minerals as it contains 300 mg Ca, 7.7 mg of mg /100 of fresh weight (Abdur Rahim *et al*., 1960).

In addition to the volatile oil, the members of the family labiatae contain di-and triterpenoids, saponins, alkaloides, polyphenols, cumarins, sugars such as raffinose and starches (Abdelaziz and Hamad, 1988).

2.4 Pest and disease:

Salim (1997) shows the main pest in Sudan growing areas of spearmint, are termites which cause serious damage and many problems. On the other hand, some problems are caused by water logging during autumn season.

2.5 Effect of fertilizer:

Spearmint is grown in different areas of Sudan. In Khartoum State it is grown widely in Kuku Project. Hulfaya, Shamabt and Elezerdab areas. Elsharfa is the famous place among others producing spearmint in Gazira State (Salim, 1997).

Spearmint grown in a wide range of soils, loamy upland soil or various types of muck (characteristic of drained, but not over drained, former swamplands) being most suited. The ground is prepared by disking several times, harrowing, dragging with a planker, and fertilizing (Guenther, 1949).

A moist situation is preferable, but mint will succeed in almost any soil when once started into growth, though in dry, sandy soils it is some times difficult to grow, and should be planted in coolest and dampest situations. (Grieve, 1970).

Singh, *et al.,* (1989) studied the economic doses of N for *mentha viridis*, *menthe peperita* and *menthe spicata*.

They found that the best N fertilization doses were 167, 153 and 145 kg N/ha respectively, and the oil yield expected were 190, 103 and 50 kg/ha respectively.

Singh, *et al*., (1992) reported that nitrogen fertilizer inputs below 200 kg urea/ha increased most growth parameters, where as the oil content of all mint species decreased at this level of urea.

Bashir (2000) found that, there was no significant different between different levels of Nitrogen and chicken manure on growth and oil content of spearmint at Shambat soil.

Shahidullah, *et al*., (1997) studied the response of *mentha spicata* to different levels of nitrogen (nitrogen applied as urea) and found that plant highest, number of branches/plant and herbage yield increased progressively with the increase in nitrogen rate up to 175 kg/ha. The highest percentage of oil (0.5%) was recorded with the application of 200 kg N/ha.

Jaskonis (1967) proved that the herbage increase with the increase NPK as applied inform of organic fertilizer, N only, N, P together or as N, K. Also there was an increase in aromatic oil.

Ghosh and Chatterjee (1933) found that the amount of oil content was increased when NPK was used.

Cupta, *et al*., (1997) reported that the best oil yield was obtained by using poultry manure.

Organic fertilizer increase organic matter content of soil (Eltibib *et al*., 1994).

CHAPTER THREE

MATERIALS AND METHODS

3.1 Materials:

3.1.1 Description of the experimental site:

The experiment in this study was carried out at the demonstration farm of faculty of Agriculture, University of Khartoum at Shamabt (Latitude 15° 40` N, longitude 32° 32` E) and altitude 380 m above the sea level, during the growing season of 2005.

3.1.2 Climate:

The climate is semi-arid, tropical, with annual rain fall of 150 to 180 mm during July to September. The mean maximum and minimum temperatures are 41°C during summer and as law as 14.1°C during winter respectively (Adam, 1996).

3.1.3 Soil:

The soil of Shambat is clay loamy type, slightly alkaline with pH 8.1. Chemical and physical properties of Shambat soil was shown in appendix one.

3.1.4 Source of plant material:

The materials used in this experiment were raised from fully spearmints mature plants grown in Kuku area (Khartoum North). The original plants were believed to be brought from Egypt long time ago through the northern part of the Sudan (Abdelaziz and Hamad, 1988). The plant was classified according to Elgazali *et al.*, (1988) as follows:

Common name:	Spearmint.
L. name:	*mentha viridis* L.
Syn. Name:	*mentha spicata* L.
Family:	Labiatae.

3.2 Methods:

The land was well prepared and divided into 18 plots. Plot area was 1 m^2 consisting of three rows. Spacing was 20 cm between plants and 20 cm between rows. Chicken manure was added to the plots and mixed with the soil before planting. The rootstocks were planted in the field on 9/7/2005 and were irrigated immediately and then after five days. Nitrogen fertilizer was added in the form of urea [2N: 173.91 lb urea/fed] and 4N (347.82 lb urea/fed)]. Weeds control was practiced as required for obtaining a good crop standard yield and quality of oil.

3.2.1 Experimentation:

The experiment investigated the effects of nitrogen and chicken manure fertilization on growth and oil content of spearmint plant. The experiment was conducted using two types of fertilizers, urea (46% N) and chicken manure.

The application of fertilizer was carried out as follow:

- 2N nitrogen (173.9 lb/fed of urea) was added after one month from planting date.
- 4N nitrogen (347.82 lb/fed of urea) was added in 3 split doses every month. Beginning one month from planting.

Chicken manure was applied as follow:

- 2.5 ton/fed.
- 5 ton/fed.

The first cutting was taken after 3 months from planting and the second cutting was taken after two months from the first cutting.

The experiment was terminated after five months from planting date.

The experimental treatments were laid-out in a randomized complete block design with three replicates.

There were 6 treatments as follows:

1- Control.

2- 2 N (173.9 lb/fed of urea).

3- 4 N (347.82 lb/fed of urea).

4- 2.5 tons/fed of chicken manure.

5- 5 tons/fed of chicken manure.

6- 2N (172.9 lb/fed urea + 2.5 ton/fed chicken manure.

3.2.2 Data collection:

3.2.2.1 Vegetative growth parameters:

Data collection for vegetative growth was carried out every 30 days. Five plants from each plot were chosen randomly and tagged) and the means for the following parameters were determined.

3.2.2.1.1 Plant height:

Plant height was measured every 30 days from the soil level to the top of the main stem in cm. The average of five plants from each plot was recorded.

3.2.2.1.2 Number of leaves:

Number of leaves on the main stem was counted every 30 days and the average was determined.

3.2.2.1.3 Number of branches:

Number of branches produced from the auxiliary buds on the main stem was counted every 30 days and the average was recorded.

3.2.2.1.4 Fresh weight of plant:

Fresh weight was determined by cutting plant from an area of 30 cm^2 of each plot after five months from planting, and weighted immediately (in grams) then the average was recorded.

3.2.2.1.5 Dry weight of plant:

The same sample that was taken for determing the fresh weight was weighted and put separately in bags and dried in an oven at 65°C for 48 hours. Then weight of the dry sample was recorded.

3.2.2.1.6 Length and weight of roots:

The length and weight of roots were measured by taking three samples from each plot and the average was determined after five months from planting date.

3.2.2.1.7 The moisture content of shoot and root:

The moisture content of shoots and roots was determined by taken 10 grams from each plot (fresh weight) then the samples were dried in an oven at 65°C for 48 hours then the dry weight was determined and moisture content was calculated as % using the following equation:

$$\textbf{Moisture content (\%)} = \frac{\textbf{fresh weight (g)-dry weight (g)}}{\textbf{fresh weight (g)}} \times \textbf{100\%}$$

3.2.3 Determination of oil content v/w:

The oil content of mint plants was determined using Clevenger apparatus.100 grams of shade-dried shoot mint were placed in 2000 ml flask. Water was added until the sample was completely immersed. The flask was brought to boil at 75°C for 3 hours. The volume of oil was determined in ml/100 g of shoots. This method was duplicated for each plot and then the average was recorded.

3.2.4 Data analysis:

Data collected were statistically analyzed using the analysis of variance (ANOVA) method and the means were separated by the least significant difference (LSD) at 5% level of significance.

CHAPTER FOUR

RESULTS

4.1 Effect of fertilization with urea and chicken manure on growth and oil content of spearmint:

4.1.1 Growth parameters:

4.1.1.1 Plant height:

The effect of urea and chicken manure on plant height was shown in table (1). The results showed that there were no significant differences in plant height between the different fertilizer treatments.

Plant height the first cuts was high in 2.5 ton/fed chicken manure treatment but at the second cutting the higher plant height was obtained by the application of 5 ton/fed chicken manure.

4.1.1.1.2 Number of leaves:

No significant differences were recorded in number of leaves among the different fertilizer levels. Before the first cutting the number of leaves was sign high in 2.5 ton/fed chicken manure treatment, table (2).

4.1.1.3 The number of branches:

Differences in the number of branches were not statistically significant among the different fertilizer levels and types. 4 nitrogen treatment at

Table (1): The effect of different level of urea and chicken manure on plant height (cm)

Treatments	After 30 days from application of urea	After 60 days from application of urea	After 30 days from first cutting	After 60 days from first cutting
Control	29.98*	43.5	21.27	35.5
2N	19.30	36.1	26.72	43.18
4N	28.19	36.67	23.40	38.47
2.5 tons c.m.	32.71	52.37	20.49	35.20
5 tons c.m.	24.39	37.04	29.48	42.93
2N +2.5 tons c.m.	29.37	41.09	24.23	41.03
LSD at 0.05	10.499	16.85	8.99	13.26

* Mean.

c. m. Chicken manure

Table (2): The effect of different level of urea and chicken manure on number of leaves

Treatments	**After 30 days from application of urea**	**After 60 days from application of urea**	**After 30 days from first cutting**	**After 60 days from first cutting**
Control	23.2*	36.6	20.4	29.47
2N	18.4	29.6	21.07	30.53
4N	23.47	35.6	18.93	30.67
2.5 tons c.m.	24.93	40.93	19.33	30.27
5 tons c.m.	22.27	35.40	22.80	33.87
2N +2.5 tons c.m.	24.4	38.27	20.40	31.33
LSD at 0.05	6.31	9.24	5.66	6.14

* Mean.

c. m. Chicken manure

4N, gave the highest number of branches in the first cutting; where as the highest number of branches was recorded by adding 5 tons/fed cm chicken manure after first cutting as shown in table (3).

4.1.2 Roots parameters:

4.1.21 Roots length:

Differences in roots length were not significant among the different fertilizer levels and types. However, application of 5 tons of chicken manure/fed highest root length; whereas 2N treatment gave the lowest value in (Table, 4).

4.1.2.2 Roots fresh weight:

The results of roots weight was shown in table (5). The result showed that there was significant difference between different levels and types of fertilizer. The highest root fresh weight was obtained by application of 2N; where as the smallest weight was obtained in the control treatment.

4.1.3 Yield parameters:

4.1.3.1 Shoot fresh weight:

The result showed that there was a significant difference between treatments. The highest fresh weight was obtained from 2N treatment and the lowest fresh weight was obtained by 4N (Table 6).

Table (3): The effect of different level of urea and chicken manure on number of branches

Treatment	After 30 days from application of urea	After 60 days from application of urea	After 30 days from first cutting	After 60 days from first cutting
Control	18.87*	27.73	16.07	25.6
2N	16.40	24.6	16.6	26.13
4N	24.43	30.73	14.73	25.6
2.5 tons c.m.	20.93	32.33	15.20	25.8
5 tons c.m.	19.77	30.83	17.73	27.53
2N +2.5 tons c.m.	21.70	31.73	15.13	26.4
LSD at 0.05	7.61	7.74	4.495	5.40

* Mean.

c. m. Chicken manure

Table (4): The effect of different level of urea and chicken manure on roots length (cm)

Treatments	**Root length (cm)**
Control	35.4*
2N	32.7
4N	34.2
2.5 ton c.m.	32.9
5 ton c.m.	35.6
2N +2.5 ton c.m.	34.7
LSD at 0.05	4.1

* Mean.

c.m. Chicken manure

Table (5): The effect of different level of urea and chicken manure on root fresh weight of the plant (g)

Treatments	Weight of fresh root (g)
Control	101.9*
2N	132.4
4N	107.1
2.5 ton c.m.	117.8
5 ton c.m.	118.6
2N +2.5 ton c.m.	109.3
LSD at 0.05	16.2

* Mean.

c.m. Chicken manure

Table (6): The effect of different level of urea and chicken manure on shoot fresh weight (g)

Treatments	**Fresh weight of shoot (g)**
Control	140.9*
2N	275.0
4N	113.9
2.5 ton c.m.	137.4
5 ton c.m.	182.7
2N +2.5 ton c.m.	130.0
LSD at 0.05	93.7

* Mean.

C. m. Chicken manure

4.1.3.2 Shoot dry weight:

Data presented in table (7) show that the dry weight was a significantly affected by the different levels and types of fertilizers. The highest value was resulted from 2N treatment where as the lowest value was resulted form 2N+2.5 ton/fed chicken manure treatment.

4.1.4 Moisture content:

4.1.4.1 Moisture content of shoots:

The result of moisture content of shoots is shown in table (8). The results showed no significant difference in moisture content of shoots between the different levels and types of fertilizer in the first and the second cutting.

4.1.4.2 Moisture content of roots:

Differences in moisture content of roots were not significant among the different levels and types of fertilizer (Table, 9).

4.1.5 Oil content:

The result of the effect of urea and chickens manure on oil content was shown in (table, 10). The results show no significant differences in the oil content in the first and the second cutting.

Table (7): The effect of different level of urea and chicken manure on shoot dry weight (g)

Treatments	Dry weight of shoots (g)
Control	40.8*
2N	62.7
4N	34.8
2.5 ton c.m.	33.1
5 ton c.m.	55.2
2N +2.5 ton c.m.	32.1
LSD at 0.05	16.3

* Mean.

c. m. Chicken manure

Table (8): The effect of different level of urea and chicken manure on moisture content of shoots (%)

Treatments	Moisture content %	
	First Cutting	Second Cutting
Control	80*	77.5
2N	78.5	80.5
4N	73.5	74.5
2.5 ton c.m.	77.5	78
5 ton c.m.	72.5	75.5
2N +2.5 ton c.m.	76.5	75
LSD at 0.05	11.1	6.5

* Mean.

c.m Chicken manure

Table (9): The effect of different level of urea and chicken manure on moisture content of roots (%)

Treatments	**Moisture content %**
Control	77*
2N	80.5
4N	78
2.5 ton c.m.	80
5 ton c.m.	75
2N +2.5 tonc.m.	81
LSD at 0.05	4.7

* Mean.

c. m. Chicken manure

Table (10): The effect of different level of urea and chicken manure on oil content of shoots mL/100 g

Treatments	Oil content mL/100g	
	First Cutting	Second Cutting
Control	1.9*	1.2
2N	2.2	1.0
4N	1.6	1.1
2.5 ton c.m.	1.9	1.3
5 ton c.m.	2.2	1.2
2N +2.5 ton c.m.	2.5	0.9
LSD at 0.05	0.9	0.4

* Mean.

c.m Chicken manure

CHAPTER FIVE

DISCUSSION

Effect of fertilization with urea and chicken manure on growth and oil content of spearmint:

Parameters of growth such as plant height, number of leaves, and number of branches.

These results showed no significant differences between the different levels of fertilizer (tables 1, 2 and 3), and this may be due to that, the up-take of nutrient was done by root system, which was not developed enough and not well established. The root did not branched enough and not spread deeper in the soil to adsorb a large amount of nutrient.

5 ton/fed of chicken manure produce high plant height this may be due to that, chicken manure affect the soil properties such aeration, porosity and reduce soil compaction and consequently this help the plant up take of nutrient due to deep penetration of roots in the soil, moreover, nitrogen increase the cell division and consequently this result lead to an increase in plant height, and phosphorus is very important constituent in nucleic acids and coenzymes and potassium which is very important for cell division and cell wall. On the other hand, the increase in plant height showed a pronounced effect at the end of second cut and this may be due to the decomposition of chicken manure in the soil and consequently their absorption

by the plant. This result was clearly confirmed by Eltilib *et al.*, 1993) on their study o okra plant height they concluded that okra plant height increase significantly with an increase of chicken manure from 0-21 ton/fed. Singh and Duhan, 1979 recommended that plant height increase with nitrogen application up to 50.4 kg/fed, but higher application produce no further increase.

The result showed no significant differences in root length and significant differences in root weight. As shown from the results the length of roots showed no significant difference at different levels of fertilizer treatments (table 4) this may be attributed to the low nutrient available for the roots system, as large amount of nutrient transferred via roots to the shoots system, and also the division and increase of the roots cells was very low compared with shoot system and the absent of chlorophyll which present in the leaves.

The weight of the roots showed a significant difference among treatments (table 5). This result may be due to an increase of roots mass by time. The 2N level of fertilizer gave highest weight, while the control treatment gave the lowest weight of the root system. This may be due to that 2N is the optimum level for growth and development while 4N level is toxic to root.

The effect of different fertilizer levels on both fresh and dry weight was showed a significant differences (table 6,7) this may due to that yield parameter were an end result of collective increment on the growth parameters (plant height, number of leaves and number of branches).

The significant differences was resulted from 2N treatment, this may be attributed to that nitrogen is an essential elements for growth and development of the vegetative parts which increase both fresh and dry weight considerably.

2N is an optimum level of nitrogen among the added levels, and consequently showed a high result of yields. On others hand 4N (large amount) may generate society and affected the growth considerably compared with the 2N.

The result shown in table (8), showed no significant differences at different levels of fertilizer in first and second cut of the shoot system. This may be due to that, the mount of moisture content do not consider as the main constituent of the dry matter of shoot and its amount of each plant it is content regardless of it is nutrients taken be the plant and consequently fertilizers application did not affect water content of the shoot system.

As mentioned by Elion, M., (1997) there is certain level moisture of content percentage for each plant type for fresh weight.

Dry weight was interfiled by oven dry to certain level of percentage moisture content.

As shown in table (9). There are no significant differences among the fertilizer levels. This may be due to the fact that is no articulation between water and nutrient, and water acts as transfer media only for nutrient form soil to the shoot system.

On the other hand the water content depend on irrigation and not depend on fertilizer because the amount of irrigation increase the water content of plant was expected to increase considerably.

The result shown in table (10) showed no significant effect of oil content among different levels of treatments.

Although oil content decrease as the nitrogen increase. This may be attributed to that, addition of nitrogen increase growth parameters such as plant height, number of leaves and number of branches. This result agree with result found by Singh *et al.,* (1992) while found that, growth parameters increased significantly with addition of N up to 63 kg/fed in all species of spearmint, but the oil content decrease with the added nitrogen.

The application of the different levels of treatment (control, 2N, 4N, 2.5cm. and 2N+2.5 cm) showed that in the first cut; the 2N+2.5 cm gave high means of oil 2.5 ml while the corresponding second cut gave low oil content (0.9 ml) among all treatment of application this is due to that in the first cut 2.5 cm is not decomposed enough and consequently reduce the oil content.

The decrease of oil at 2N level between first cut (2.2 ml) and second cut (1ml) was attributed to the increasing growth parameters as shown in (tables 1, 2, 3) and this reduce the oil content in the second cut as mentioned above by Singh *et al.,* (1992).

The decrease of oil at 4N treatment was due to the increase in the level of (N) fertilizers and the oil was high in first cut (1.55 ml) and low on second cut (1.1 ml) this was due to that the up take of nitrogen was first low then it was increased in second with time.

SUMMARY AND CONCLUSION

This study was carried out at the Nursery of the Faculty of Agriculture, at Shambat to show the effect of different levels of nitrogen and chicken manure on the growth and oil content of the spearmint (*mentha spicata*). Treatments were organic and nitrogen fertilization, applied as control (without fertilizer), 173.9 lb/fed of urea, 347.82 lb/fed of urea, 2.5 ton/fed of chicken manure, 5 ton of chicken manure and 173.9 lb/fed urea +2.5 ton/fed chicken manure.

The treatments show that, there is no significant different on the growth and oil content but it affect the yield parameters positively.

The conclusions drown from this study were as follow:

1- The higher fresh weigh were obtained by the application of 173.9 lb/fed urea.
2- The chicken manure fertilizer gave the positive results as urea, so it can be used instead of chemical fertilizers.
3- Further experiments on fertilizer applications (urea and chicken manure), time of sowing date, interval of cuttings of spearmint are needed.

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APPENDIX I

Chemical and physical properties of the soil

Soil depth (cm)	**PH (paste)**	**Nitrogen (%)**	**Phosphorus (ppm)**	**Water soluble cations (meq/L)**			**Soil texture**			**Textural class**
				K	Ca	Mg	% Sand	% Silt	% Clay	
0-30	8.1	0.067	0.78	2.13	2.75	3.5	40.6	8.1	51.2	Clay loam
30-60	8.1	0.058	0.53	1.89	2.00	1.5	39.1	7.5	53.1	Clay loam

APPENDIX II

Average of some meteorological data at Shambat during experimental period (May 2005- December 2005)

Element / Month	Mean Temperature ºC			Relative Humidity %	Total Rainfall (MM)	Wind	
	Maximum	Minimum	Mean			Direction	Speed (Knots)
January	29.3	12.1	20.7	25	0.0	N	5
February	37.0	17.4	27.2	24	0.0	N	6
March	37.3	18.6	28	17	0.0	N	7
April	41.2	23.0	32.1	19	TR	N	6
May	40.7	22.9	31.8	23	12.3	N	5
June	41.7	27.3	34.5	25	0.0	S	5
July	38.5	25.2	31.9	41	32.2	S	6
August	37.9	25.6	31.8	44	60.3	S	5
September	39.1	25.3	32.2	39	0.7	S	5
October	39.8	23.8	31.8	29	TR	N	4
November	35.6	19.6	27.6	25	0.0	N	6
December	34.1	16.8	25.5	34	0.0	N	5
Total/annual					105.5		

Key:

Knot = 1.85 km/hr = 0.5 m/s

1.15 mile/hr = 1.69 feet/s

N = North

S = South

W = West

E = East

TR = Trace

N/E = North by East

Appendix III

Analysis of Variance

Table 1. The effect of different level of urea and chicken manure on plant height after 30 days from application of urea

S. of V	d.f	M.S
Block	2	75.9755 NS
Treatment	5	68.4368NS
Error	10	33.3088
Total	17	

NS: Not significant

Table 2. The effect of different level of urea and chicken manure on plant height after 60 days from application of urea

S. of. V	d.f	M.S
Block	2	151.3315 NS
Treatment	5	116.2992NS
Error	10	85.7545
Total	17	

NS: Not significant

Table 3. The effect of different level of urea and chicken manure on plant height after 30 days from first cutting

S. of V	d.f	M.S
Block	2	14.853 ^{NS}
Treatment	5	34.343 ^{NS}
Error	10	24.3973
Total	17	

NS: Not significant

Table 4. The effect of different level of urea and chicken manure on plant height after 60 days from first cutting

S. of. V	d.f	M.S
Block	2	24.202 ^{NS}
Treatment	5	37.896 ^{NS}
Error	10	53.126
Total	17	

NS: Not significant

Table 5. The effect of different level of urea and chicken manure on number of leaves after 30 days from application of urea

S. of. V	d.f	M.S
Block	2	9.849 ^{NS}
Treatment	5	16.414 ^{NS}
Error	10	12.0142
Total	17	

NS: Not significant

Table 6. The effect of different level of urea and chicken manure on number of leaves after 60 days from application of urea

S. of. V	d.f	M.S
Block	2	30.949 ^{NS}
Treatment	5	42.8184 ^{NS}
Error	10	25.8022
Total	17	

NS: Not significant

Table 7. The effect of different level of urea and chicken manure on number of leaves after 30 days from first cutting

S. of. V	d.f	M.S
Block	2	3.449 ^{NS}
Treatment	5	5.667 ^{NS}
Error	10	9.6782
Total	17	

NS: Not significant

Table 8. The effect of different level of urea and chicken manure on number of leaves after 60 days from first cutting

S. of. V	d.f	M.S
Block	2	4.729 ^{NS}
Treatment	5	6.9264 ^{NS}
Error	10	11.3742
Total	17	

NS: Not significant

Table 9. The effect of different level of urea and chicken manure on number of branches after 30 days from application of urea

S. of. V	d.f	M.S
Block	2	43.76 ^{NS}
Treatment	5	22.1876 ^{NS}
Error	10	17.4787
Total	17	

NS: Not significant

Table 10. The effect of different level of urea and chicken manure on number of branches after 60 days from application of urea

S. of. V	d.f	M.S
Block	2	42.424 ^{NS}
Treatment	5	25.9738 ^{NS}
Error	10	18.0866
Total	17	

NS: Not significant

Table 11. The effect of different level of urea and chicken manure on number of branches after 30 days from first cutting

S. of. V	d.f	M.S
Block	2	4.442 ^{NS}
Treatment	5	3.7902 ^{NS}
Error	10	6.1063
Total	17	

NS: Not significant

Table 12. The effect of different level of urea and chicken manure on number of branches after 60 days from first cutting

S. of. V	d.f	M.S
Block	2	3.309 NS
Treatment	5	1.5862 NS
Error	10	8.8236
Total	17	

NS: Not significant

Table 13. The effect of different level of urea and chicken manure on roots length

S. of. V	d.f	M.S
Block	2	21.461 NS
Treatment	5	4.5666 NS
Error	10	5.056
Total	17	

NS: Not significant

Table 14 The effect of different level of urea and chicken manure on weight of fresh roots of plant

S. of. V	d.f	M.S
Block	2	108.5075 NS
Treatment	5	345.9386 *
Error	10	79.268
Total	17	

NS: Not significant

* Significant

Table 15. The effect of different level of urea and chicken manure of fresh weight of shoots

S. of. V	d.f	M.S
Block	2	2628.155 NS
Treatment	5	10536.353 *
Error	10	2651.273
Total	17	

NS: Not significant

* Significant

Table 16. The effect of different level of urea and chicken manure on dry weight of shoots

S. of. V	d.f	M.S
Block	2	242.927 NS
Treatment	5	493.7698 *
Error	10	80.44
Total	17	

NS: Not significant

* Significant

Table 17. The effect of different level of urea and chicken manure on moisture content of shoots in first cutting

S. of. V	d.f	M.S
Treatment	5	16.88 NS
Error	6	20.416

Total	11	

NS: Not significant

Table 18. The effect of different level of urea and chicken manure on moisture content of shoots in second cutting

S. of. V	d.f	M.S
Treatment	5	10.33 NS
Error	6	7
Total	11	

NS: Not significant

Table 19. The effect of different level of urea and chicken manure on moisture content of roots

S. of. V	d.f	M.S
Treatment	5	10.88 NS
Error	6	3.74
Total	11	

NS: Not significant

Table 20. The effect of different level of urea and chicken manure on oil content of shoots in first cutting

S. of. V	d.f	M.S
Treatment	5	0.22025 NS
Error	6	0.12604
Total	11	

NS: Not significant

Table 21. The effect of different level of urea and chicken manure on oil content of shoots in second cutting

S. of. V	d.f	M.S
Treatment	5	0.084 ^{NS}
Error	6	0.031
Total	11	

NS: Not significant