Effect of Nitrogen and Phosphate Fertilizers on the properties of vegetative growth and aromatical oil yield of Local mint (*Mentha spicata* L.)

تأثير التسميد النتروجيني والفوسفاتي على صفات النمو الخضري وحاصل الزيت العطري لنبات النعناع المحلي *Mentha spicata* L.

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Abstract

A field experiment was conducted in the season of 2005-2006 in a private farm in Najaf province. The aim was to investigate four mixtures of nitrogen and phosphate fertilizers i.e. (0, 100 kg $N.ha^{-1}$, 150 kg $P_2O_5.ha^{-1}$, and 100 kg $N.ha^{-1}$ + 150 kg $P_2O_5.ha^{-1}$) on vegetative growth properties and oil yield of local mint. A simple experiment was performed using Completely Randomized Design (C.R.D.) with three replications. The means were compared according to L.S.D. (Least significant Difference) at 0.05 probability level.

Results showed that the nitrogen and phosphate fertilizers improved the vegetative growth properties (plant height, number of leaves and branches, vegetative yield ($ton.ha^{-1}$) and total chlorophyll content in leaves). Oil yield increased significantly compared with non-fertilized plants.

The fertilized plant with (100 kg $N.ha^{-1}$ + 150 kg $P_2O_5.ha^{-1}$) gave the highest parameters, such as plant height (64.26 cm), number of branches (8.36 $branch.plant^{-1}$), vegetative yield (10.44 $ton.ha^{-1}$) and total chlorophyll (7.01 $mg.100\ g^{-1}$ fresh weight). In addition to that there was a significant increase in oil yield to (53.72 $kg.ha^{-1}$) as compared with non-fertilized plants which gave the least vegetative parameters and less oil yield (46.71 $kg.ha^{-1}$). The conclusion of this experiment it is useful to use nitrogen and phosphate fertilizers together to improved the vegetative growth, and oil yield of the local mint plant.

المستخلص

اجريت تجربة حقلية لموسم 2005-2006 في مزرعة خاصة في محافظة النجف الاشرف لاختبار تأثير اربعة توليفات من الاسمدة النتروجينية والفوسفاتية هي (0 ، 100 كغم N.هكتار$^{-1}$ ، 150 كغم P_2O_5.هكتار$^{-1}$ و 100 كغم N.هكتار$^{-1}$ +150 كغم P_2O_5.هكتار$^{-1}$) في صفات النمو الخضري وحاصل الزيت العطري لنبات النعناع المحلي. نفذت تجربة بسيطة بالتصميم العشوائي الكامل .C.R.D بثلاثة تكرارات. قورنت المتوسطات حسب اختبار اقل فرق معنوي .L.S.D وعلى مستوى احتمال 5%.

اظهرت النتائج ان التسميد بالاسمدة النتروجينية او الفوسفاتية قد حسن صفات النمو الخضري (ارتفاع النبات ، عدد الاوراق ، عدد التفرعات ، الحاصل الخضري (طن.هكتار$^{-1}$) ومحتوى الاوراق من الكلورفيل الكلي) وحاصل الزيت معنوياً مقارنة بالنباتات غير المسمدة.

هذا وقد اعطت النباتات المسمدة بـ (100 كغم N.هكتار$^{-1}$ + 150 كغم P_2O_5.هكتار$^{-1}$)اعلى المؤشرات ، اذ وصل ارتفاع النبات ، عدد التفرعات ، الحاصل الخضري ومحتوى الاوراق من الكلورفيل الكلي الى (64,26سم ، 8,36 فرع.نبات$^{-1}$ ، 10,44 طن.هكتار$^{-1}$ و 7,01ملغم.100 غم$^{-1}$ مادة طرية) بالاضافة الى زيادة حاصل الى (53,72 كغم.هكتار$^{-1}$) معنوياً مقارنة بالنباتات غير المسمدة والتي اعطت اقل المؤشرات الخضرية واقل حاصل زيت عطري بلغ (46,71 كغم.هكتار$^{-1}$).

يستنتج من التجربة ان التسميد بالاسمدة النتروجينية والفوسفاتية معاً قد حسن من صفات النمو الخضري وحاصل الزيت العطري لنبات النعناع المحلي.

Introduction

After two centuries of continuous decline in using of herbal medicines, interest in them started again. Medicinal herbs, which were the final form of medicine in developing countries, have become used again in the developed world where people do their almost to stay healthy in challenge environmental pollution. They resort to consult herbal medical specialist trainees (herbalists).

Widely, used medicinal herbs which were used by their parents and grandparents. Herbal drug sales rose in Europe and went to 10% in England and 35% in Spain (1).

Mint plants are medicinal plants used from the old time, and dried leaves were found in the Pyramids of Egypt (3000 BC). The Municipal mint (*Mentha spicata* L.) is one of the important species of Labiatae family in Iraq. The crop is used as necessary medical sedative of nerves, and useful in the treatment of asthma, bronchitis used to treat intestinal disorders and infectious live and renal colic and to prepare toothpaste (2). Mint Included in the industry of perfume, soap and some food products such as sweets and biscuits (3).

Mint is green plant with a particular smell aromatic, perennial, with height of 30-155 cm. The green leaves are picked and dried in the shade, crushed, squeezed and used as needed. The leaves contain aromatic oil with Menthol. Mint is used in salads to open appetite. Syrup made from mint has a good taste. The powdered dried mint is added to certain foods to exceed the flavor and alleviate the impact of acidity (3).

Because of the importance of high medical mint and for the purpose of improving the growth of vegetation and increased the sum of aromatic oils , it is necessary to use many agricultural operations, including the fertilization, which help to increase the yield and improve the quality and increase the growth of different genus of Mentha. It was found also that the aromatic mint plant needs mineral fertilization during long periods of growth. Nitrogen fertilization leads to increase vegetation growth and content of the oil of pepper mint (3).

Studies showed that nitrogen fertilization increased the growth and the vegetation yield of mint. (4) showed that , the quantity of oil had increased as a result of nitrogen and phosphate fertilization. (5) found that increased in dry matter yield was obtained by 21% when plants fertilized by nitrogen and phosphate fertilizers. (6) found that the green yield of Japanese mint (*Mentha arvensis* L.) has increased significantly by increasing the amount of nitrogen fertilizer up to 90 kg $N.ha^{-1}$, significant increase in oil yield such as 26.3, 57.6, and 86.3% under conditions of adding nitrogen at 30, 60, and 90 $kg.ha^{-1}$, respectively.

Besides, Japanese mint (*Mentha arvesnsi*s L.) responded to the level of nitrogen fertilization of (75 $kg\ N.ha^{-1}$) and gave significant increase in green production by (7%) compared with treatment of 50 $kg\ N.ha^{-1}$ (7). (8) found that the addition of nitrogen fertilizer for the two types of mint led to an increased growth in terms of plant height, dry matter and oil. (9) noted that the nitrogen addition to the pepper mint plant led to an increase plants height, increase the length of leaves seven times, and an increase in green yield six-fold comparison to plants without nitrogen fertilization which gave the lowest production.

(10) showed that increasing levels of nitrogen fertilization from 0 to 150 $kg\ N.ha^{-1}$ led to an increase in the quantity of dry matter oil yeild. At 150 $kg\ N.ha^{-1}$ treatment, the oil yield increase to 55.64 in local mint plants (*Mentha spicata* L.). (1) explained that fertilization with 100 $kg\ N.ha^{-1}$ and 60 $kg\ P_2O_5.ha^{-1}$ increased growth and green yield significantly of Japanese mint (*Mentha arvensis* L.).

Because of the lack information about the effect of nitrogen and phosphate fertilization on vegetative growth and oil quantity of the local mint grown in Iraq, this study was performed .

Materials and Methods:

Experiment was conducted in a private farm in the province of Najaf - Iraq, The land was tilled, adjusted, settled and divided into12 panels ($1\times1.2\ m^2$) contained three lines spaced at 30 cm. the date of planting local mint was 20/11/2005. Seven seeds were planted in each line 15 cm apart.

Phosphate fertilizer was added as a single dose before planting in the form of triple super phosphate (46% P_2O_5) at the rate of (150 $kg\ P_2O_5.ha^{-1}$), while nitrogen fertilizer was added as a dose of 100 $kg\ N.ha^{-1}$ in form of urea fertilizer (46% N) after two weeks of planting. All processes were conducted; such as service, irrigation, controlling diseases and insects at all experimental units whenever necessary (2).

The experiment was conducted using a Complete Randomized test with a single factor. There was four nitrogen and phosphate levels; the combinations are (100 $kg\ N.ha^{-1}$) only (F1), (150

kg P_2O_5.ha^{-1}) only (F2), nitrogen and phosphate together (F3). Control treatment was with out adding nitrogen and phosphate (F0). Means were compared by the test of least significant difference at the level of 0.05 probability level (12).

Five plants from the middle of median row had been tested from each experimental unit for measuring the height of plants, number of leaves, number of branches, vegetative yield, dry matter weight for the unit area and the total chlorophyll of the fifth leaf from the top of the plants. Chlorophyll was extracted by acetone 85% .Then, it was determined using (Spectrophotometer) on Wavelength of 663, 645 (13).

The essential oil was distilled from the leaves of mint using steam distillation, as described in (3).

Results and Discussion

Table (1) showed that fertilization by nitrogen or phosphate had increased significantly the height of plant, number of leaves and branches, vegetative yield, dry matter weight and the total content of chlorophyll compared with other plants (control), which gave the least values.

However, there were no significant differences between the treatment of nitrogen fertilization and Phosphates in the vegetative yield, dry matter weight and content of total chlorophyll.

But there was a significant difference in the number of branches at phosphate fertilizer which reached (8.13 branch.leaf^{-1}) compared with nitrogen fertilizer which gave (6.32 branch.leaf^{-1}). The reason was that the phosphorus and nitrogen were essential elements for plants and worked to give strength to grow and increased in the number of branches in the plant (14).

Both (9) on the pepper mint and (10) on the local mint found that nitrogen fertilization increased the height of plants and green yield, as well as (10) who founds that an increase in nitrogen fertilization caused an increase in dry matter in the two types of mint.

Fertilization with each of nitrogen and phosphate fertilizers increased significantly the aromatic oil yield compared with the control plants. (Table 1).

Fertilization with (100 kg N.ha^{-1} + 150 kg P2O5.ha^{-1}) increased significantly height of plant to(64.26 cm), number of leaves per plant (100.62),number of branches (8.36 branch in plant), vegetative yield (10.44 tons / ha), the dry matter weight (1.22 tones.ha^{-1}) and of total chlorophyll (7.01 mg.100 gm^{-1}, fresh weight) compared with control plants which their height of (31.13 cm), number of leaves (70.61 leaf), number of branches (5.03 Branch), green yield (7.22 tones.ha^{-1}), dry matter weight (0.64 tons.ha^{-1} total chlorophyll (5.23 mg.100 gm^{-1} soft, fresh weight) respectively . This improvement of vegetative growth may be due to the nitrogen which affected many biological processes inside the plant, such as photosynthesis , protein synthesis and encourages vegetative growth That led to increase plant growth , leaf elongation, and increase brighten of leaves, (14). High rate of plant growth can be achieved only when sufficient quantities of nitrogen are ready (15).

In addition to that, phosphorus is important component to stimulate photosynthesis. It is important part in rich energy compounds and strengthens roots system (14).This leads to increase vegetative growth and chlorophyll content of leaves. This was similar to what (5) found that the dry matter and the number of leaves and branches increased when adding nitrogen and phosphate fertilizer to plant.

Aromatic oil increased significantly in fertilized with nitrogen and phosphate which reached 53.72 kg.ha^{-1} compared with control plants , which gave the least amount of oil (46.71 kg.ha^{-1}) (Table 1) , the increase in the amount of oil is due to the increase of dry matter as a result of increased vegetative growth (Table 1).This was confirmed by (4) that the yield and quantity of oil increased as a result of nitrogen and phosphate fertilizers together.

It could be inferred from this experiment that fertilization with a mixture of nitrogen and phosphate improved both vegetative growth and aromatic oil of mint plant.

Table 1: Effect of nitrogen and phosphate fertilization on vegetative growth and aromatic oil of local mint plant

Aromatic ($kg.ha^{-1}$) oil	Total chlorophyll in leaves ($mg.100g^{-1}$, fresh weight)	Dry matter ($kg.ha^{-1}$)	vegetative yield ($ton.ha^{-1}$)	No of branches $\cdot plant^{-1}$	No. of . leaves $plant^{-1}$	Plant height (cm)	treatments
46.71	5.23	0.64	7.22	5.03	70.61	31.13	(control) F_0
50.22	6.91	1.15	9.86	6.32	90.41	59.58	F_1 (100 kg N/ha)
51.91	6.43	1.03	9.71	8.13	81.01	50.78	F_2 (150 kg P_2O_5/ ha)
53.72	7.01	1.22	10.44	8.36	100.62	62.26	F_3 (100 kg N/ha) + (150 kg P_2O_5/ ha)
2.92	0.63	0.19	1.93	1.12	8.65	5.76	L.S. D

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