

Original Research Article

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## Effect of Different Level of Nitrogen, Phosphorus and Potassium on Growth and Green Herb Yield of *Origanum vulgare*

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### ABSTRACT

#### Keywords

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*Origanum vulgare* (oregano) is a member of the Lamiaceae family and is an indigenous aromatic and medicinal plant of Mediterranean region. At present, it is cultivated the mild, temperate climates of Europe, Asia, North Africa, and America in a large scale due to its economic importance. However, it is commercially grown. The objective of this study was to examine the effects of different level of N, P and K on green herb yield and some herb chemical constituents (N, P, K) in order to recommend a reliable nutrient management for commercial growers. Results showed that, yield generally increase in accordance with the increases in N, P and K fertilizer rates.

### Introduction

Oregano (*Origanum vulgare* L.) belongs to the *Lamiaceae* family, which is indigenous to the Mediterranean region. It also is distributed and cultivated in many areas of the mild, temperate climates of Europe, Asia, North Africa, and America (Ietswaart, 1980; Goliaris *et al.*, 2002). Oregano plays a primary role among culinary herbs in world trade. Traditionally, leaves and flowers of oregano are used in Lithuania mostly for their beneficial properties to cure cough and sore throats and relieve digestive complaints (Ien *et al.*, 2008).

Oregano contains essential oils, rich in the two isomeric phenols carvacrol and thymol (Fleisher and Sneer, 1982; Kokkini and Vokou, 1989 and Vokou *et al.*, 1993). The use of oregano as a medicinal plant is attributed to the biological properties of the herb and its essential oil composition. Findings report that oregano is antimicrobial (Didry *et al.*, 1993; Chun *et al.*, 2005 and Paster *et al.*, 2005), an antioxidant (Capecka *et al.*, 2005 and Jaloszynski *et al.*, 2008), and probably stimulates the appetite (Ien *et al.*, 2008).

On the other hand, Karik et al. (2007) indicated that the secondary metabolites specific to the aromatic and medicinal plants are mainly controlled genetically but are strongly affected by environmental influences. Moreover, balanced nutrition of the thyme plant has not been examined thoroughly until recently. It is claimed that in order to achieve standard crops and standard quality oil yields, the commercial thyme growers need to practice well managed cultivated production systems (Bayram, 2003). In this regard, the significance of N fertilization is related (Ceylan, 1996) to visible emphasis of N on vegetative growth and to herbage area increase which directly increases the total oil yield. Baranauskienė et al. (2003) state the disadvantages of excess N fertilization which often results with high leaf NO<sub>3</sub> concentrations. Palada et al. (1998) recommended 50 to 150 kg ha<sup>-1</sup> N for *O. vulgare* L. as a concluding remark to his N fertilization testing. The same author also reports the beneficial effects of cow manure and urea as N sources (Palada et al., 1995) which are generally practiced in two splits; in spring and after the first harvest. However, not much information is found on the efficient use of P and K fertilizers. Some growers apply P and K during the soil preparation in spring in the form of compound fertilizers. Ateia et al. (2009) claimed that the mixture of compost + sheep manure applied at 3:1 ratio give high essential oil yields. The content of essential oils and their composition are affected by different factors, including genetic makeup (Muzik et al., 1989) and cultivation conditions, such climate, habitat, harvesting time, water stress, and the use of fertilizer (Min et al., 2005; and Stute, 2006).

The improvement of plant nutrition can contribute to increased resistance and production when the crop is submitted to

water stress. Plant nutrition is one of the most important factors that increase plant production. Nitrogen is most recognized in plants for its presence in the structure of the protein molecule. In addition, nitrogen is found in such important molecules as purines, pyrimidines, porphyrines, and coenzymes. Purines and pyrimidines are found in the nucleic acids RNA and DNA, which are essential for protein synthesis. The porphyrin structure is found in such metabolically important compounds as the chlorophyll pigments and the cytochromes, which are essential in photosynthesis and respiration. Coenzymes are essential to the function of many enzymes. Accordingly, nitrogen plays an important role in synthesis of the plant constituents through the action of different enzymes. Nitrogen limiting conditions increase volatile oil production in annual herbal. Nitrogen fertilization has been reported to reduce volatile oil content in *Juniperus horizontalis* (creeping juniper) (Fretz, 1976), although it has been reported to increase total oil yield in oregano (*Origanum vulgare*) (Baranauskienė et al., 2003). However, studies on agronomic factors such as application of potassium humate and irrigation intervals as well as nitrogen fertilization on yield and essential oils of oregano have not been investigated thoroughly until now.

The objective of this study was to recommend a reliable nutrient management for commercial wild thyme growers by examining the effects of different rates of N, P and K fertilizations on green herb yield (leaf + stalk + flower) and some herb nutrients (N, P, K).

### **Materials and Methods**

Seed or one-month-old seedling or small size plant will be selected for cultivation. The net plot size will be kept at 1.35\*1.00m.

twenty seven treatment combinations of fertilizers would be consisted with three levels nitrogen (0,75,150 kg./ha.). Three levels of phosphorus (0,125,250 kg./ha.) and three level of potassium (0,75,150 kg./ha.). Nitrogen will be supplied by urea, single super phosphate and murate of potash respectively. The hole quantity of phosphorus half of potash and nitrogen was applied at the time of planting the rest half dose of nitrogen and potash was given one month after planting. Seedling were planted in well prepared flat beds by spacing 20\*15 cm. or according to plant size as suggested by pal and phogat 1984. The observation on plant growth, yield per hectare, leaf area index, rhizome yield will be recorded. Profit would be examined and production will be popularized among local youth.

Experiment plot would be selected on botanical garden L.S.M.P.G.College Pithoragarh, Uttrakhand, India.

### Results and Discussion

Green herb yields were found generally higher in the second year of the experiment in all of the treatments. Each year, yield response to the enhanced, K and P fertilizations were found positive and statistically significant at 1% level. The interaction effect of N, P and K fertilizations on yield was not found significant in the first year where as was determined significant in the second year (Table 2). In this context,

the highest yield was obtained in the highest rate of N (150 Kg urea /ha.) P (125 kg phosphorus/ha.) and K (150 kg potash/ha.) fertilizations. Nutrient elements (N, P and K) of the green herb were also analyzed in both of the study years. Results of the statistical analyses showed that the herb N, P and K contents were significantly higher. On the other hand, in the first and second years of this study, statistically significant interaction effects of N, P and K fertilizations were determined on the N, P and k contents of the herb respectively.

The data of this study showed that N ,P and K fertilizations positively affect the developments in *Origanum vulgare* , its yield as well as its quality as a medicinal and herbaceous plant. Among many plant growth factors, the nutritional requirements of the crops are considered to be the most important factor. Generally the growth, development, yield and the quality of herbs are affected by genetic background; however, environment and the cultural practices are as well important (Karik, et al., 2007). It is well known that P is an essential element in reproductive and vegetative growth and flower number can increase by the increased P applications (Mengel and Kirkby, 2001). Phosphorus also has many other cellular functions in plants and affects the primary and secondary metabolites. Therefore, P fertilization in medicinal herbs is strongly recommended especially in cites with low available soil P (Marschner, 1995).

**Table.1 Soil Properties of Experimental Site**

Site	Colour (dry)	elevation	Soil text	Particle-size distribution(%)			Ph (1:2.5)	Org carbon Kg <sup>-1</sup>	Cec Cmo (p+) Kg <sup>-1</sup>
				Sand (2.0-0.05 mm)	silt (0.05-0.002 mm)	Clay (<0.002 mm)			
L.S.M.G.P.G.C. Pithoragarh	Olive yellow	1498	silt	7.6	68.9	23.5	5.9	14.7	9.3

**Table.2** Effect of N, K and P Fertilization on Green Herb Yield (kg/ha.) for 2011 and 2012 Seasons

Combination no.	First season (2011)	Second season (2012)
C1	15500	16800
C2	16000	17400
C3	16500	18600
C4	17000	19800
Mean	16250	18150

C1=control,C2=N(150 kg/ha.)+P(250 kg/ha.)+K(75 kg/ha),C3=N(75 kg/ha.)+P(0 kg/ha.)+K(75 kg/ha.) and C4=N(150 kg/ha.)+P(125kg/ha.)+K(150 kg/ha.)

**Table.3** Effect of N, P And K Fertilization on N, P and K Conent (%) For2011 and 2012 Seasons

Combination no.	%					
	N		P		K	
	First season (2011)	Second season (2012)	First season (2011)	Second season (2012)	First season (2011)	Second season (2012)
C1	1.825	1.825	0.252	0.252	1.072	1.072
C2	1.828	1.830	0.258	0.268	1.140	1.165
C3	1.830	1.832	0.252	0.252	1.180	1.190
C4	1.833	1.837	0.262	0.272	1.200	1.225
Mean	1.829	1.831	0.256	0.261	1.148	1.163

C1=control,C2=N(150 kg/ha.)+P(250 kg/ha.)+K(75 kg/ha),C3=N(75 kg/ha.)+P(0 kg/ha.)+K(75 kg/ha.) and C4=N(150 kg/ha.)+P(125kg/ha.)+K(150 kg/ha.)

Similarly, it is also very well known that K fertilizers improve growth parameters and yield quality (Mengel and Kirkby, 2001). Potassium fertilizers proved its role in plant metabolism, carbohydrate synthesis, water transport in xylem, cell elongation. Singh (2001) reported that addition of K resulted with higher herb yields.

In this current study, green herb yield, some of the herb nutrient elements like N, P, K positively responded to N, P and K fertilizer treatments. The highest herbal yield was determined in 150 kg urea/ ha.+1 25 kg phosphorus/ ha.+150 kg potash/ha. treatment in both of the study seasons. It is worth reporting that this specified highest yield obtained from the 150kg urea/ ha.+ 125 kg phosphorus/ ha. +150kg potash /ha.

The present study can be concluded that if the herb yield evaluated and weighed and

ranked according to the treatments, we can reach the conclusion that if economically viable 150 kg urea, 125 kg phosphorus and 150 kg Potash per hectare could be recommended for about 19800 kg of green herb yield ha-1. In case N fertilization is necessary according to soil testing, recommendations should be followed.

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