International Scholars Journals

African Journal of Agricultural Economics and Rural Development ISSN 2375-0693 Vol. 6 (5), pp. 647-649, May, 2018. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Short Communication

Evaluation of nitrogenous fertilizer influence on some quantity and quality values of balm at Iran

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Accepted 15 March, 2018

An experiment was carried out using a randomized complete block design (RCBD) with three replications to study the nitrogenous fertilizer influence on quantity and quality values of balm (*Melissa officinalis* L.) at Iran Research Institute of Forest and Rangelands during 2005. The factor studied included nitrogenous fertilizer of ourea (0, 60, 90, 120, 150 and 180 kg ha^{-1}). The analysis of variance showed that N fertilizer had significant effect on biological yield, essential oil percentage, essetial oil content, plant height and tiller number (P 0.01). Highest biological yield (6788 kg ha^{-1}) and plant height (61.63 cm) were produced by application of 90 kg N ha^{-1} and highest tiller number (32.6 tiller/plant), essetial oil percentage (0.2577%) and essetial oil content (16.05 kg ha^{-1}) were obtained under application of 60 kg N ha^{-1}. The results showed that optimal application of N fertilizer increased quantity and quality values of balm, but application of inordinate N fertilizer reduced all plant values. Consequently, our finding may give applicable advice to farmers and medicinal and aromatic plants researches for management and proper use of N fertilizer in farming of balm.

Key words: Nitrogenous fertilizer, biological yield, essetial oil percentage, essetial oil content and *Melissa officinalis* L.

INTRODUCTION

Balm (*Melissa officinalis* L., Lamiaceae) a perennial herb native to southern climates of Europe and North America, is presently found in both wild and cultivated states. Several other species of *Melissa* have been reported from the Mediterranean and central Asian areas, but only *M. officinalis* L. is cultivated. The plant grows erect and reaches a height of 0.5 - 1 m. The highest levels of essential oil have been extracted in late summer from the lower parts of the plants (Kennedy et al., 2006). The essential oil contains geraniol, citronellol, cintronellal, linalool, eugenol acetateand nerol. The essential oil is often adulterated with mixtures of lemongrass, citronella, or lemon oil. Oil of balm has also been shown to have antiviral, antibacterial and antispasmodic activity. Balm has been reported to be an insect repellent. As a medicinal plant, lemon balm has traditionally been employed against catarrh, fever (Kabala-Dzik et al., 2004), flatulence (Weizman et al., 1993) and headaches (Wake et al., 1999). A field experiment was conducted during 1992 - 94 at India to study the effect of nitrogen levels (0, 200 and 400 kg N ha^{-1}) on herb and oil contents of Java citronella (*Cymbopogon winterianus* Jowitt.). Their results have shown that highest herb and oil contents of citronella were achieved under the application of 400 kg N ha^{-1} and quality of oil was not affected by nitrogen fertilizer (Singh et al., 2008). Sharifi and Abbaszadeh (2003) investigated the effect of N fertilizer on essential oil content and composi-tions of fennel (*Foeniculum vulgare* Mill) aerial parts and N application increased essential oil content. Ram et al. (2005) evaluated two variables of organic mulch (control and sugarcane trash at 7 t ha^{-1}) and three levels of nitrogen (0, 100 and 200 kg ha^{-1}). Application of N at 200 kg ha^{-1} in the mulched plots significantly enhanced the N uptake by the crop and essential oil content of mint (*Mentha arvensis* L.) over the control and 100 kg N ha^{-1} applied in the mulched/or unmulched plots and 200 kg N ha^{-1} applied in the unmulched plots. A study was carried out with lemongrass (*Cymbopogon flexuosus*) during 1993 - 95 under four rates of nitrogen application (0, 50, 100 and 150 kg ha^{-1}) . Nitrogen application significantly increased crop growth values such as plant height, leaf

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Table 1. Analysis of variance.

Source of variation	df	Mean squares				
		Tiller number	Essential oil percentage	Essential oil content	Biological yield	Plant height
Replication	2	2.167	0.457	0.07	0.384	11.325
Nitrogenous fertilizer	7	126.738**	2.097**	0.717**	1.073**	302.344 **
Error	14	1.881	0.278	0.077	0.202	16.156
CV (%)		5.06	18.96	15.08	14.43	7.05

** and *: Significant at 1% and 5% levels respectively.

Table 2. Means comparison.

Treatment		Tiller number (tiller/plant)	Essential oil (%)	Essential oil content (kg ha^{-1})	Biological yield (kg ha^{-1})	Plant height (cm)
Different levels of nitrogenous fertilizer application	0	26 ab	0.1053 b	3.45 d	3267 c	37.64 d
	60 kg N ha^{-1}	32.6 a	0.2577 a	16.05 a	6215 a	54.81 b
	90 kg N ha^{-1}	31.81 a	0.139 b	9.44 b	6788 a	61.63 a
	120 kg N ha^{-1}	31.8 a	0.1083 b	5.71 c	5288 b	49.5 c
	150 kg N ha^{-1}	30.33 a	0.0977 b	3.42 d	3496 c	34.66 e
	180 kg N ha^{-1}	19.82 b	0.0913 b	3 d	3286 c	30 f

Means within the same column and factor, followed by the same letter are not significantly difference ($p < 0.05$).

area index (LAI), herbage and essential oil contents. An application of 100 kg N ha^{-1} was found to be optimal for crop yield (Singh, 1999). Therefore, the objective of this study was to evaluate the nitrogenous fertilizer influence on some quantity and quality values of balm (*M. officinalis* L.) at Iran.

MATERIALS AND METHODS

This study was conducted on experimental field of Iran Research Institute of Forest and Rangelands (35°48' N, 51°01' W; 1320 m above sea level) with sandy soil, relative humidity (68%), mean annual temperature (16°C) and rainfall in the study area is distributed with an annual mean of 235 mm. The field experiment was carried out using a randomized complete block design (RCBD) with three replications. The factor studied included nitrogenous fertilizer of urea (0, 60, 90, 120, 150 and 180 kg ha^{-1}). Initially, plant nutrient need of phosphorus and potassium were added by applying 100 kg ha^{-1} ammonium phosphate and 150 kg ha^{-1} K_2O at cultivation time respectively. In order to determination of essential oil percentage by Clevenger, were selected 100 g shooting dry matter at the end of flowering period from each plot. Finally, essential oil content was determined by the following formula (Aliabadi Farahani et al., 2008).

Essential oil content = Essential oil percentage × Shoot yield

To determine biological yield, plant height and tiller number, 10 plants were selected randomly from each plot at maturity. The data were subjected to analysis of variance (ANOVA) using Statistical Analysis System (SAS) computer software at $P < 0.05$ (SAS institute Cary, USA 1988).

RESULTS AND DISCUSSION

The results showed that N fertilizer had significant effect on biological yield, essetial oil percentage, essetial oil content, plant height and tiller number [p 0.01, Table 1]. Highest biological yield (6788 kg ha^{-1}) and plant height (61.63 cm) were produced by application of 90 kg N ha^{-1} and highest tiller number (32.6 tiller/plant), essetial oil percentage (0.2577%) and essetial oil content (16.05 kg ha^{-1}) were obtained under application of 60 kg N ha^{-1} (Table 2). However, nitrogen element isn't in essential oil components, but the our final results indicated that applications N fertilizer increased essential oil content of balm, because the nitrogen develops leaf area and lateral stem and because of increase of the essential oil content. The interaction between the amount of the essential oil percentage and flowering shoot yield is considered important as two components of the essential oil content. However, the essential oil percentage reduced under application of N fertilizer but essential oil content increased under this condition, because flowering shoot yield increased under application of N fertilizer. Therefore, each increaser factor of essential oil percentage and flowering shoot yield, can increases essential oil content. Also, the results showed that optimal N application increased quantity and quality values of balm. Nitrogen is the major nutrient that influences plants yield and protein concentration. When the amount of available soil N limits yield potential, additions of N fertilizers can substantially

increase plants yield. However, plants protein concentration can decrease if the amount of added N is not adequate for potential yield. Chemical fertilizers are generally used far in excess of the requirements of the plants. The unutilized fertilizers cause soil pollution. Ammonium fertilizers produce ammonia around the roots that may escape the soil and cause ammonia injury to plants. Ammonium and nitrate produce acids in the soil and increase soil acidity. Nitrate and nitrite are reduced while ammonifying bacteria are increased in the soil disturbing the nitrogen cycle. Excessive deposition of various substances released from chemical fertilizers into the soil generally causes their over-absorption by plants. These over absorbed substances become accumulated in plant parts (bioaccumulation) e.g. nitrogen and sulphur are deposited in the leaves. Effects of industrial effluents various inorganic and organic substances are present in the industrial effluents. These substances mostly remain tied up in the soil and are not readily available to plants. However, they affect various soil values. Effluents affect the mineral structure, soil pH, exchangeable base status etc of the soil and thus indirectly affect the plants. The pH of the soil is disturbed making soil either acidic or alkaline. Various inorganic and organic chemicals are accumulated in the soil up to levels toxic to plants. In highly polluted soils, plants absorb and accumulate toxic substances. These substances may or may not produce direct injury symptoms in plants but are passed on to higher trophic levels.

Conclusion

The results showed that optimal N application increased quantity and quality values of balm. Our findings are most important for the non-pollution of soil by inordinate N fertilizers.

ACKNOWLEDGMENTS

The authors thank Dr. Mohammad Reza Ardakani, Dr. Farzad Paknejad, Dr. Ebrahim Sharifi Ashoorabadi and Dr. Mohammad Hossein Lebaschi for their field assistance and analytical support in processing the plant samples and collecting the data reported herein.

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