

Original Article

THE STUDY OF BIOMETRIC AND VOLATILE OIL QUANTITY OF SAGE PLANT
(*SALVIA OFFICINALIS*) AS MEDICINAL PLANT AFFECTED BY NITROGEN AND PHOSPHORUS
FERTILIZERS

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ABSTRACT

Objective: The study was designed to evaluate the effect of nitrogen and phosphorus fertilizers on growth parameters and volatile oil percentage of leaves.

Methods: The field experiment was conducted during winter growing season (2011 – 2012). The experiment included five treatments: control treatment (without fertilizer), (160 kg N ha⁻¹ with 60 kg P ha⁻¹), (180 kg N ha⁻¹ with 80 kg P ha⁻¹), (230 kg N ha⁻¹ with 60 kg P ha⁻¹) and (230 kg N ha⁻¹ with 80 kg P ha⁻¹). The plant samples were taken by randomly chosen from the middle rows of each plot at vegetative stage, and the volatile oil of leaves was extracted by using a Clevenger apparatus.

Results: The results were referred to significant differences between control and other treatments. The highest values of all growth parameters and volatile oil percentage of plant leaf were obtained at (230 kg N ha⁻¹ with 80 kg P ha⁻¹) treatment and reached to 482 g plant⁻¹, 163 g plant⁻¹, 23 branch plant⁻¹, 55 cm plant⁻¹ and 2.10 % for fresh leaf weight, dry leaf weight, branches number plant⁻¹, plant height and volatile oil percentage respectively, while the lowest values of all growth parameters and volatile oil percentage were obtained at control treatment (without fertilizer) and reached to 164 g plant⁻¹, 51 g plant⁻¹, 7 branch plant⁻¹, 35 cm plant⁻¹ and 0.77 % for fresh leaf weight, dry leaf weight, branches number plant⁻¹, height of plant and volatile oil percentage of leaves respectively.

Conclusion: From this study the result and discussion, it has been concluded that nitrogen and phosphorus fertilizers are very necessary for growth and active compounds biosynthesis of medicinal plants. The effects of nitrogen and phosphorus fertilizers may belong to the role of these elements in accumulation of chlorophyll material which is very important in photosynthesis process and other physiological processes in plant. The increasing of volatile oil percentage of sage leaves with increasing of levels of both fertilizers may be due to the effect of these elements especially the phosphorus element on the synthesis of tricyclic – glycerol from glycerol -3- phosphate which leads to increased levels of mevalonic acid and isoprene unit which are building blocks of terpenoids of volatile oil.

Keywords: Sage, *Salvia officinalis* L., Volatile, Fertilizers.

INTRODUCTION

Sage (*Salvia officinalis* L.) is considered among the important medicinal and food plants belonging to the Labiatae family which is shown in Fig (1). It is a hardy perennial herb with white to purplish flowers, leaves are green to gray-green and may be hairy or rough [1]. Different species of sage plant are widely distributed through middle western Europe and the Mediterranean area [2]. Sage oil is used as a food flavor and a fragrance component in soaps, detergents and perfumes. Sage species are rich in diterpene compounds such as salvividinol, vidridinol and viridone that are used as antibacterials in herbal medicine all-around the world [3]. The cultivation of several medicinal and aromatic plants in Iraq has noticeably increased in recent years. The use of most suitable and recommended agricultural practices such as fertilization in medicinal plants production could provide the drug industry a suitable active compound and provide the farmer higher income as compared with other plants or crops [4,5]. Nitrogen and phosphorus are considered as essential elements for the growth and active constituents biosynthesis of medicinal plants [6]. So the objective of this study is to evaluate the effect of the nitrogen and phosphorus fertilizers on growth parameters and volatile oil percentage of sage plant.

MATERIALS AND METHODS

The field experiment was conducted during winter growing season (2011-2012) at Mohammed Al Qasem plantation of Agriculture Ministry of Iraq at Baghdad region. The physical and chemical properties of soil were presented in Table (1). Sage seeds were obtained from Al - Wadi Al Khather office for natural products, and planted under green house in 1/9/2011. After the seedling height

reached to about 10 cm were transplanted to field experiment place. The field treatments were arranged according to Randomized Complete Block Design (RCBD) with three replicates and included 15 plots. The area of each plot was six square meters (6m²) contained four rows with 40 cm as distance between plants and 75 cm between rows. After fifteen days from transplanting the seedlings were thinned to one per hill. The fertilizer application included two levels of nitrogen 150 and 230 kg ha⁻¹ as (urea of 46% nitrogen) while the levels of phosphorus fertilizer were 60 and 80 kg ha⁻¹ as (48 – 52 % P₂O₅), all replicates included a control treatment (without fertilizer). The plant samples were taken by randomly chosen from the middle rows of each plot at vegetative stage before flowering, and the volatile oil of leaves was extracted by water distillation method by using a Clevenger – type apparatus [7,8]. All data were statistically analyzed by ANOVA and treatment means were compared by using least significant differences (LSD) at 5% level of probability [9].

RESULTS AND DISCUSSION

The influence of nitrogen fertilizer on fresh and dry leaves weight of sage plant was recorded in Table (2). The results were referred to nitrogen application was enhanced plant growth parameters at all levels and gave significant differences compared with control treatment (without fertilizer). The highest values of fresh and dry leaf weight were 482 and 163.62 g/ plant at (230 kg N ha⁻¹ and 80 kg P ha⁻¹) treatment. These results were in agreement with other study of fennel plant that gave highest fresh and dry leaf weight when treated with nitrogen fertilizer under semi-arid condition [10]. The effect of nitrogen may belong to the role of nitrogen in accumulation of chlorophyll material which is very important in photosynthesis process [11]. Data recorded in Table (2) showed clearly that

number of branches per plant and plant height were increased significantly with nitrogen application compared with control treatment, also this effect may be concluded that nitrogen fertilizer especially in 230 kgNha⁻¹ level was stimulated dry matter production at various growth stages [12]

Phosphorus application was gave significant increasing in all growth parameters at (230 kgNha⁻¹ and 80kg p ha⁻¹) and (230 kg Nha⁻¹ and 60 kg P ha⁻¹) treatments, and the highest values were obtained at 80 kg Pha⁻¹ level with 230 kgN ha⁻¹ level and reached to 482 g plant⁻¹, 163.62 plant⁻¹, 23 branch plant⁻¹ and 55 cm plant⁻¹ for fresh leaf weight, dry leaf weight, number of braches per plant and plant height respectively . The influence of phosphorus fertilizer on growth parameters of Sage plant my be belong to the role of P in improving plant growth and matter accumulation can be a scribed to its role in enhancing the nutrient uptake by plants [13]. Generally on the bases of the obtained results it could be concluded that nitrogen

and phosphorus have a positive effect on the growth and other physiological process of sage plant .

Data recorded in the table (2) showed to increasing of both fertilizers lead to increasing of percentage of leaf volatile oil .The significant increasing was obtained at (230 kg N ha⁻¹ with 80 kg Pha⁻¹) and (230 kg Nha⁻¹ with 60 kg Pha⁻¹) treatments compared with control treatment (without fertilizer) . The highest values of volatile oil were reached to 1.60% and 2.10 % at (230 kg Nha⁻¹ with 60 kg P ha⁻¹) and (230 kg N ha⁻¹ with 80 kg P ha⁻¹) treatments respectively. The increasing of percentage volatile oil by increasing nitrogen and phosphorus fertilizers may be due to the effect on the synthesis of tricyclic – glycerol from glycerol -3- phosphate which lead increased a mevalonic acid and isoprene unit which a building block torpedoed of volatile oil, also the phosphorus element have important rule for aromatic ring as building block of two important molecule phosphoenolpyruvic acid – erthros -4- phosphor [14].

Table 1: The physical and chemical properties of field experiment soil before planting

Components	Units	Results
Silt	%	64.21
sand	%	16.54
clay	%	37.25
Density	g / cm ⁻²	1.21
Soil Texture	-	Silt – clay
pH	-	7.7
Ec	ds.m ⁻¹	4.7
Available N	mg/kg ⁻¹	88.10
Available P	mg/kg ⁻¹	12.8
Available K	mg/kg ⁻¹	271
Organic matter	%	1.43

Samples were tested at soil and water recourse Dep. of Agriculture college of Baghdad University.

Table 2: Effect of nitrogen and phosphorus fertilizers on growth parameters and volatile oil of Sage plant

Treatments Kgh ⁻¹	FLW g/plant	DLW g/plant	No. of Branches / plant	Plant height (cm / plant)	Volatile Oil (%)
(No. Po)	146	51.25	7	35	0.77
(N160.P60)	235	80.38	11	42	1.20
(N180.P80)	274	92.50	13	41	1.33
(N230.P60)	400	136.00	18	45	1.60
(N.230.P80)	482	163.62	23	55	2.10
L.S.D(0.05)	28	11.70	10.9	30.25	0.70

FLW: Fresh leaf weight, DLW: Dry leaf weight

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