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The Effects of Different N Doses and Harvesting Times on Bulb Yield and Some Plant Characters of Summer Snowflake (*Leucojum aestivum* L.)

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Abstract: The effects of different N doses and harvesting times on bulb yield and some plant characters of summer snowflake were studied in Samsun, Turkey ecological conditions for three years. First two year, planted bulbs were left to growth and in the third year at the beginning of vegetation, different N doses (0, 5, 10, 15 and 20 kg da^{-1}) were applied in two times with 30 day interval at the same amount. Treated plants were harvested in June and July of 2002. According to the results, different harvesting time had no effect on parameters evaluated in this study, but increasing N doses resulted in an increase in bulb yield, bulb diameter, plant height, leaf number per plant and crude protein content of bulb.

Key words: *Leucojum aestivum*, nitrogen, fertilization, bulb yield, harvesting times

INTRODUCTION

The use of natural products with therapeutic properties is as ancient as human civilization. The industrial revolution and the development of organic chemistry resulted in a preference for synthetic products for pharmacological treatment. But, there has been an increasing tendency in using of plant-originated raw matters in medicinal treatment due to some reasons such as synthetic products have some adverse effects on human health and are very expensive or plant-originated matters have multifunctional effects in contrast to synthetic products[1]. Today, about 25% of the drugs prescribed worldwide and 121 active compounds being in current use come from plant. Of the 252 drugs considered as basic and essential by the World Health Organisation (WHO), 11% are exclusively of plant origin and a significant numbers are synthetic drugs obtained from natural precursors. It is estimated that 60% of anti-tumour and anti-infectious drugs already on the market or under clinical trial are of natural origin[2]. The vast majority of these cannot yet be synthesised economically and are still obtained from wild or cultivated plant[3].

Summer snowflake (*Leucojum aestivum* L.) called as akçabardak, kabalak, sarıklı kökü by Turkish folk is 30-60 cm height and a perennial bulbous living in high and moist pastures of North Anatolia in our country and found naturally in Bafra, 19 Mayıs, Tekkeköy, Çarþamba and Terme vicinities of Samsun[4]. It is an important export material for our country. Likewise, 6.480.080 bulbs were exported in 1999[5]. But the plant is face to face with extinction, because its exported bulbs are obtained rather than by collecting in pastures[6]. This plant has recently attracted scientific concern due to its various secondary metabolite contents. Its ethanol extract exhibits antiviral effect[7] and have some secondary metabolites, namely galanthamine, lectins and chelidonic acid, having multifunctional pharmacological effects[8]. Galanthamine found in whole plant and especially in bulbs is a dibenzofuran-type alkaloit[9] and its anticholineesterase [10], anaesthetic[11], analeptic and analgesic[12] effects were demonstrated by relevant studies. Besides, the alkaloid has been used in treatment of Alzheimer, infantile paralysis[13] and some kind of neurological disorders[11].

Nitrogen is one of the most important plant nutrition for almost all crop plants and its growth enhancing effect is more evident in vegetative part evaluated plant like summer snowflake. To harvest plant at different date or development stages, some times, has affected quality and quantity of crops significantly[14]. Thus, in this study, to determine the effects of different N doses and harvesting times on bulb yield and some plant characters of summer snowflake was aimed.

MATERIALS AND METHODS

The experimental area: This Study was conducted out at Blacksea Agricultural Research Institute, Samsun located

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on The Blacksea coast of Turkey between 2000 and 2002. During the experimental period, annual precipitation was 698, 637 and 729 mm for 2000, 2001 and 2002, respectively.

Some major soil characteristics were found to be as follows; the soil texture is clay-loam, pH is 6.45, organic matter is 3.03%; extractable P by 0,5 N $NaHCO_3$ extraction is 4.2 mg kg^{-1}; exchangeable K by 1 N NH_4OAc extraction is 61 mg kg^{-1} and EC is 1.42 mS cm^{-1} in soil saturation extract.

The experimental procedures: The experiment was planned according to split-split block design arrangement with 3 replications. Each treatment plot was 3x7 m with a distance of 0.5 meter each plot. Summer snowflake bulbs used as material were obtained from Bilge Incorporated Company/ Trabzon-Turkey. N treatment doses were 0, 5, 10, 15 and 20 kg da^{-1} and ammonium sulphate (21% N) was N sources.

Bulbs were planted in the experimental area fertilized by 8 ton ha^{-1} farm manure with 40x10 cm plant-row spacing in September of 2000. After giving enough times to plants for adapting to the new environment, Half of the N doses were applied at the end of January and the remaining were applied at the beginning of rapid growth period of this plant (end of February) in 2002. Fertilizer was broadcasted by hand and then buried by a rake without disturbing planted bulb. Matured bulbs were harvested at the beginning of June and July of 2002 after ignoring 0.5 m area from all sides of the plots. During vegetation, plant height and leaf number per plant; after harvesting, bulb diameter and lateral bulb number per harvested bulb were determined as plant characters. Besides, bulb yield, crude protein and ash ratio was counted for each plot.

The data were objected to ANOVA and differences among treatments were tested Duncan Multiple Range Test (Level of significance $P<0.05$).

RESULTS AND DISCUSSION

According to the results of ANOVA, different harvesting times performed had no significant effect on parameters evaluated in this study, while increasing N doses brought about an increase in bulb yield, bulb diameter, plant height, leaf number per plant and crude protein content of bulb (Table 1).

Summer snowflake has some secondary metabolites, namely galanthamine, lectins and chelidonic acid, having multifunctional pharmacological effects[8]. But its medicinal importance has arisen from its galanthamine content to a great degree and it found in bulbs the most intensively. For that reason, bulb is the most important organ of this plant. In this study, increasing N doses enhanced bulb yields significantly ($P<0.05$). The highest bulb yield was obtained from 20 kg da^{-1} N doses with 597.50 kg da^{-1}. This number was followed by 15 and 10 kg da^{-1} N doses (580.52 and 567.57 kg da^{-1}, respectively) while control plots gave the lowest value (490.00 kg da^{-1}). Similar results were reported by Astadzhov[15].

The increase in bulb yield was, probably, related to increases in bulb diameter and leaf number per plant. Because, 20 and 15 kg da^{-1} N treatments resulted in the most highest bulb diameter with 36.50 and 34.53 mm when compared to control. Similarly, leaf number per plant was the highest in 20 kg da^{-1} N treatment with 8.42 followed by 15 and 10 kg da^{-1} N treatments found in the same statistical group (7.28 and 6.56, respectively). Leaves are the most important photosynthetic organ of plants[16] and generally there is a positive relation between total leaf area and generative or vegetative yield in crop plants[17]. Likewise, correlation analysis performed to determine the degree of the relation between bulb yield and leaf number per plant revealed significant and positive relation ($R=0.875$).

Generally, the most expected results of N fertilisation in crop plants are the increase in vegetative development and crude protein content of different plant parts[18]. Because, N is the main component of living cell and amino acids. Just as we determined an increase in plant height and crude protein content of bulbs. In this respect, the highest plant height and crude protein percentage were obtained from 20 and 15 kg da^{-1} N treatments (47.57 and 47.37 cm; 2.07 and 1.95%, respectively). In contrast to bulb yield and plant characters mentioned above, lateral bulb number per harvested bulb and crude ash ratio of bulbs were not affected N treatments evaluated in this study (Table 1). Consequently, to get the highest bulb yield and plant growth in summer snowflake, 20 kg da^{-1} N dose was recommended.

Table 1: The effects of different N doses on bulb yield and some plant characters of summer snowflake as mean of two harvesting times

N doses (kg da^{-1})	Bulb yield (kg da^{-1})	Plant height (cm)	Leaf number per plant	Bulb diameter (mm)	Protein content of bulb (%)	Lateral bulb number per bulb	Ash content of bulb (%)
0	490.00d*	42.63b	5.52d	27.72c	1.15d	1.20	2.15
5	560.50c	45.20b	6.22c	30.59b	1.50c	1.00	2.06
10	567.57c	46.80a	6.56b	33.65ab	1.67b	1.10	2.15
15	580.52b	47.37a	7.28b	34.53a	1.95ab	1.15	2.20
20	597.50a	47.57a	8.42a	36.50a	2.07a	1.32	2.00
Mean	559.22	45.92	6.80	32.60	1.67	1.15	2.11

*Values followed by different small letters in columns are significantly different ($p<0.01$)

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