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Effect of Dates and Rates of Sowing on Yield and Yield Components of Lentil (*Lens culinaris* Medik.) Under Semi Arid Conditions

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Abstract: Field experiments were conducted during the winter seasons of 1998-1999, and 1999- 2000 in northern Jordan, to study the effect of date and rate of sowing on the yield and yield components of lentil (*Lens culinaris* Medik.). Progressive delay in sowing beyond 1st December a yield reduction of 20.8 and 40.1 % was recorded with successive delays in sowing at every 20 days interval. Plant height, primary branches plant^{-1}, secondary branches plant^{-1}, number of pods plant^{-1} and 100-grains weight followed the same trend as yield. Seed yield was not significantly affected by sowing rate.

Key words: *Lens culinaris* Medik., sowing date, sowing rate, grain yield, semi- arid.

Introduction

Lentil is an important protein source for the people in Jordan and countries of West and South Asia and North Africa. The crop is grown under rainfed conditions and in rotation with cereals such as wheat and barley. Lentil is usually grown as a winter crop, which is known to be produced under the marginal lands where rainfall is low and soil productivity is poor. The area planted to lentil in Jordan decreased by more than 50 % in the last 10 years (1990-1999) and the production has also significantly decreased. At the same time the imports were growing fast. The imports from lentil seeds increased to reach 5,000 tons in 1999 with a value of 2.5 million $US (FAO., 1999). A number of studies, from inside and outside Jordan, have been reported on the optimum seeding date for lentil. In Jordan, higher yields were obtained by seeding the lentil cultivars Jordan and Precoz in early November as compared with late seeding in January (Humied and Haddad, 1981). In Egypt, higher yields were recorded in cultivar Giza 9 seeded on 31st Oct. than on 15 Nov. or 1st Dec. (Abdel-Rahman *et al.*, 1980). Krarup (1984) from Chile reported higher yields from lentil sown from mid-August to mid-September than from later sowings. In Saskatchewan, Slinkard and Drew (1980) reported higher yields when lentil was seeded in early May compared to late May or early June seeding. Earlier studies have shown that seeding rate or planting density is an important factor-affecting yield of grain legumes. Therefore, yield response of seed legumes to seeding rates were discussed by several workers, and different relative values between hay and seed yield with seeding rate were found (Murray and Slinkard, 1969; McEwen *et al.*, 1988; Martin *et al.*, 1994; Noffsinger and Santen, 1995; Tawaha and Turk, 2001). Humied and Haddad (1981) reported that a seeding rate of 80-kg ha^{-1} gave the highest yields for their cultivars. In Chile, Krarup (1984) reported that yield remained relatively constant over a wide range of seeding rates. However, seeding rate is cultivar dependent due to wide range of seed size among cultivars. In Saskatchewan, a plant population of 100 plants m^{-2} is recommended for optimum yields (Slinkard, 1976). The present investigation aimed to examine the effect of sowing rate and sowing date and their interactions on the yield and the yield components of lentil under Mediterranean conditions.

Material and Methods

A 2-years field study was carried out during 1998-99 and 1999-2000 in north Jordan. The location has Mediterranean climate of mild rainy winters and dry hot summers. The soils were rocky, shallow and silty clay with a pH of 8.1 and available phosphorus ranged from 23 to 60 kg ha^{-1}. Phosphorus was supplied in the form of Triple superphosphate (21% P). The phosphate fertilizer was drilled with the seed after cultivation. Nitrogen fertilizer was applied uniformly by hand across all treatments [20 kg N ha^{-1} at sowing in form of Urea (46 % N) and 40 kg N ha^{-1} top-dressed at the start of flowering]. Weeds were controlled by hand as needed. A split- plot arrangement in a randomized complete block design with three replications was used. Seeds of the locally planted lentil cultivar (*Lens culinaris* Medik.) were sown on different dates (1st Dec., 20th Dec. and 10th Jan.) in the main plots, seeding rates (65 and 85kg seed ha^{-1}) kept in sub plots. Sub-plot area was 4.0 m^2 consisting of 4 rows (2 outer rows as borders), 0.25 m apart and 4m long. Guard strips of 0.5 m between main plot and 1.5 m between blocks were left. Measured variables included seed yield (kg ha^{-1}), 100 seeds weights (g) and number of pods plant^{-1}; primary branches plant^{-1}, secondary branches plant^{-1}and plant height (cm). The analysis of variance and LSD mean separations were performed using computer statistical program MSTAT-C (MSTAT-C manual, 1989) as described RCBD with split-plot arrangement according to procedure outlined by Steel and Torrie (1980). Comparisons between means were made using the least significant difference test (LSD) at 0.05-probability level.

Results and Discussion

No significant interaction between seasons was detected. Therefore, the presented results are means across the two growing seasons. Grain yield of lentil was influenced significantly by date of sowing (Table 1). The maximum grain yield of 1010 kg ha^{-1} was obtained by sowing lentil on 1 Jan, which was found superior to the latter dates of sowing, with progressive delay in sowing beyond 1st December a yield reduction of 20.8 and 40.1 % was recorded with successive delays in sowing every 20 days interval. The seed yield of lentil under different dates of sowing

Table 1: Yield and yield components of lentil (*Lens culinaris* Medik.). as influenced by rate and dates of sowing under rainfed semi arid condition.

Treatments	Seed yield kg ha^{-1}	Plant height (cm)	100 seeds weight (g)	Primary branches plant^{-1}	Secondary branches plant^{-1}	No. of pods plant^{-1}
Seed rate						
Low	800	29.7	4.3	5.7	4.7	11.0
High	810	31.3	4.0	4.7	3.3	6.0
LSD	35.3	3.3	2.0	2.3	2.1	1.5
Date of Sowing						
1st Dec	1010	36.5	5.1	6.0	5.0	9.0
20th Dec	800	29.5	4.3	5.5	4.5	6.5
10th Jan	605	25.5	3.0	4.0	2.5	4.6
LSD	56.0	4.1	1.4	1.4	1.2	1.3
Rate X date	NS	NS	NS	NS	NS	NS

was significantly influenced by its attributes i.e. plant height, primary branches plant^{-1}, secondary branches plant^{-1}, number of pods plant^{-1} and 100 grains weight which followed the same trend as yield. The reduction in grain yield due to delay in sowing can also be attributed to shorter growth period at the disposal of the late sown crop as the time taken by the crop to mature decreased with delay in sowing. Same result was reported by Tawaha and Turk (2001) for narbon vetch.

The grain yields of two seeding rates were not statistically different. The result found in this study is consistent with Saxena *et al.* (1983) who found a significant effect of seeding rate on lentil grain yield. It may be attributed to the diversified agroclimatic conditions. It is obvious from the above discussion that supplementing the traditional seed rate of 65 kg ha^{-1} does not contribute to a significant increase in lentil grain yield in the north Jordan. It is concluded that the higher seeding rate causes higher inter-plant competition and results in poor individual plant vigor. In other, words increased plant population is at the expense of branching in individual plants. Therefore, the application of 65 kg of seed ha^{-1} is recommended.

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