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Effect Of Seed Size and Plant Spacing on Yield and Yield Components of Faba Bean (*Vicia faba* L.)

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Abstract: A field experiment was conducted in season (2001/2002) in the Demonstration Farm of the Faculty of Agriculture, University of Khartoum, at Shambat. The objectives of the study were to investigate the effect of seed size and plant spacing on yield and yield components of faba bean (*Vicia faba* L.) cultivar Kabkabia. The treatments consisted of four seed size categories (small, medium, large and ungraded bulk) and three plants spacing of (10, 20, and 30 cm) between holes. The treatments were laid in a factorial experiment in Complete Randomized Block Design (CRBD) with four replications. Increasing plant spacing increased the number of pods per plant pods per main stem and consequently gave the highest seed yield. Seed size had no significant effect on yield and other investigated characters.

Key words: seed size, plant spacing, faba bean

INTRODUCTION

Faba beans (*Vicia faba* L.) are among the most important food legume crops in the Sudan. It provides a major part of the daily diet for the population. In the Sudan, the crop is grown mainly under irrigation in an area of about 102.381 ha, mainly in the Northern parts of the Sudan where the environmental conditions suit its production better than in other parts of the country[10]. Small amounts of seeds are also produced in Khartoum State, Central Sudan and Jebel Marra area in Western Sudan[9].

Constraints that contribute to low productivity of faba bean in the traditional faba bean areas include improper cultural practices and lack of good seed qualities. Thus failure in obtaining satisfactory stands is frequent and replanting adds additional costs, although congenial climates are prevailing throughout faba bean cropping areas in the Sudan.

In order to extend and improve the production of the crop in some traditional faba bean areas in Darfur (Kabkabia and Zalingei), a research works have to be conducted on various agronomic problems such as seed grading in term of seed size and plant spacing as major factors determining grain yields. Studies of this nature are virtually lacking in faba bean cultivar Kabkabia a newly introduced cultivar to the area of Kabkabia in Western Sudan.

The present work is an attempt to study the effects of different seed size classes and plant spacing on the yield and yield components of *Vicia faba var. Kabkabia*.

MATERIALS AND METHODS

A field experiment was conducted in season (2001/2002) in the Demonstration Farm of the Faculty of Agriculture, University of Khartoum, at Shambat. (Latitude 15˚ 40′ N and Longitude 32 ˚ 23′ E) The soil of the experimental site was investigated and reported by Saeed[6]. His data revealed that the soil is a heavy clay (46% clay) and alkaline (PH= 8.05).

The experiments consisted of four seed size classes and three intra-plant spacing. The seeds of cultivar Kabkabia were sorted visually by hands into three size classes viz; large, medium and small. A fourth group of the original seed (ungraded) was used as a control. The three seed classes and the ungraded seed bulk formed four treatments comparisons namely; large, medium, small and ungraded bulk, thereafter being designated as L, M, S, and U with mean weights in gramme/100-seeds of 73.7, 50.2, 29.4 and 49.0 respectively. Spacing treatments will be denoted as S1, S2, and S3 for 10, 20, and 30 cm respectively.

Sowing was conducted on the first week of November 2001. Seeds were sown on the both sides of the ridge at the intra-plant spacing of 10, 20, and 30 cm with three seeds per hill things was made to two seedlings per hill and that was after two weeks from emergence to give a theoratical plants population of 142000, 71000 and 47000 plants per hectare for intraplant spacing 10, 20 and 30cm respectively.

The four seed size classes and the three intra-plant spacing were combined together consisting twelve treatments which were organized in a factorial experiment in Complete Randomized Block Design (CRBD) with four replications.

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The experimental unit was 12-m^2 plot with four ridges per plot and 70-cm spacing between ridges.

Data were collected on plant stand percentage and seed yield. Plant stand % was determined by counting the number of plants at harvest (actual plant stand) expressed as a percentage of the stand counted after thinning (theoretical plant stand).

The following components of seed yield were also measured such as number of pods per plant, number of seeds per pod and 100-seed weight. Seed yield was determined by harvesting seed from an area of 2.8 m^2 from each treatment, and the total seed yield per hectare was estimated. The analysis of variance was carried out for the results and the treatment means were separated using the least significant difference (LSD) according to the procedure described by Gomez and Gomez[4].

RESULTS AND DISCUSSION

Plant Stands Percentage: Plant spacing had a highly significant effect (P >0.01) on plant stand percentage, planting at 30 cm spacing led to a significantly higher plant stand percentage (Table 1). Higher plant density seems to favour early full canopy development and increased the interception of light, but this advantage may well be out weighted by mutual shading and increased lodging due to weaker stems.

Seed size treatments resulted in a non-significant effect on plant stand percentage (Table 1).

Number of Pods per Plant: Plant spacing showed a significant effect (P >0.05) on mean number of pods per plant (Table 2). 30 cm plant spacing resulted significantly in a higher number of pods per plant. Dantuma and Thampson [2] reported that the number of pods per plant appeared to be the least stable yield components in faba bean.

The increase in the number of pods per plant with increasing plant spacing may be due to increase in the number of pods per node as the result of higher net assimilation rates and reduction of competition in wider spacing. Stutzel and Aufhammer[12] reported similar findings.

Seed size had no effect on the mean number of pods per plant (Table 2).

Number of Seeds per Pod: The effect of seed size and plant spacing on number of seeds per pod was inconsistent because it is a relatively stable character in faba bean[5]. However, in this study, values indicated that the number of seeds per pod was significantly affected by plant spacing (Table 3). This result might be due to the fact that widely spaced plants suffer less from competition than closely spaced plants and thus were expected to grow and yield better. Supporting evidence was found by Abo El-Zahab *et al*[1] and Salih[7].

Table 1: Effect of seed size and plant spacing on plant stand% at harvest of faba bean var. Kabkabia for 2001/02 season.

Treatments	Plant spacing			Mean
	S_1	S_2	S_3	
Seed size		S.E ±0.02		S.E ±0.01
S	79.3	74.3	81.4	78.3
M	85.0	69.9	93.2	82.7
L	85.4	72.5	94.5	84.1
U	85.8	70.8	91.9	82.7
		S.E ±0.01		
Mean	83.9a	71.9b	90.3c	82.0

C.V = 17%

Plant spacing means followed by the same latter(s) are not significantly different at 0.05 level of probability.

Table 2: Effect of seed size and plant spacing on the mean number pods/ plant of faba bean var. Kabkabia for 2001/02 season.

Treatments	Plant spacing			Mean
	S_1	S_2	S_3	
Seed size		S.E ±3.23		S.E ±1.88
S	29.7	25.5	31.8	29.0
M	23.8	20.5	24.8	23.0
L	27.6	21.1	29.9	26.2
U	17.8	24.1	28.6	23.5
		S.E ±1.62		
Mean	24.7a	22.8bc	28.8a	25.4

C.V = 25.4%

Table 3: Effect of seed size and plant spacing on the mean number seeds/ Pod of faba bean var. Kabkabia for 2001/02 season.

Treatments	Plant spacing			Mean
	S_1	S_2	S_3	
Seed size		S.E ±0.22		S.E ±0.12
S	3.2	3.5	3.5	3.4
M	2.9	3.0	3.3	3.1
L	2.9	3.1	3.2	3.1
U	3.0	2.9	3.3	3.1
		S.E ±0.11		
Mean	3.0a	3.1ac	3.3bc	3.2

C.V = 13.9%

Table 4: Effect of seed size and plant spacing on mean 100-seed weight of faba bean var. Kabkabia for 2001/02 season.

Treatments	Plant spacing			Mean
	S_1	S_2	S_3	
Seed size		S.E ±4.24		S.E ±2.45
S	48.2	44.0	46.9	46.4
M	50.8	58.4	51.4	53.5
L	47.0	55.8	49.9	50.9
U	56.6	53.6	40.2	50.1
		S.E ±2.12		
Mean	50.7	52.9	47.1	50.3

C.V = 16.9%

Seed size did not show a significant effect on the number of seeds per pod (Table 3).

100-seed Weight: The effects of seed size and plant spacing on 100-seed weight were not significant (Table 4). However, as a general trend, and in contrast to the number of seeds per pod, the closer plant

Table 5: Effect of seed size and plant spacing on mean seed yield (t/ha) of faba bean var. Kabkabia during 2001/02 season.

Treatments	Plant spacing			Mean
	S_1	S_2	S_3	
Seed size		S.E ±0.25		S.E ±0.14
S	3.20	3.21	3.76	3.39
M	3.13	3.02	3.57	3.24
L	2.81	3.18	3.12	3.04
U	2.90	3.34	3.18	3.14
		S.E ±0.12		
Mean	3.01	3.19	3.41	3.20

C.V = 15.5%

spacing gave the heaviest weight. These results support the finding of Sutzel and Aufhammer[12] that, seed weight is negatively correlated with the number of seeds per pod in many crops. Furthermore, pod abscission in closer spacing creates favourable filling conditions for the remaining pods.

Seed Yield: Varying intra-plant spacing had a significant effect (P >0.05) on yield of faba bean (Table 5). Sprent *et al.*[11] realized that the prime effect of increasing density more likely to be due to altered competition within adjacent plants than mutual shading. Based on the range of seed grades used, seed size had no significant effect on seed yield of faba bean (Table 5). Similar results were reported by Salih and Salih[8] and Dawood[3].

It can reasonably be concluded that the results of this study showed that grading the faba bean seeds to different seed size classes had no significant effect on seed yield. Accordingly, it is not useful to grade the seeds to different seed sizes and that will be of little or no economic value to farmers.

For economical and best seed yield, faba bean should be planted on hill 30 cm plant spacing.

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