Advances in Environmental Biology, 7(1): 82-85, 2013
ISSN 1995-0756

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Correlation between Seed Yield and Yield Components in Faba Bean (*Vicia faba* L.)

[1]Ahmed Ali Mohamed Osman [1]Abdel Aziz Hamid Abdel Aziz, and [2]Mohamed Bakheit Gailani

[1]*College of Agricultural Studies, Sudan University for Science and technology, Khartoum, Sudan*
[2]*Faculty of Agricultural Technology and Fish Sciences, Al Neelain University, Khartoum, Sudan*

Ahmed Ali Mohamed Osman Abdel Aziz Hamid Abdel Aziz, and Mohamed Bakheit Gailani: Correlation between Seed Yield and Yield Components in Faba Bean (*Vicia faba* L.)

ABSTRACT

An experiment was conducted for two successive seasons 2002/03 and 2003/04 at the Demonstration Farm of the College of Agricultural Studies, Sudan University for Science and Technology to evaluate four genotypes of faba bean (*Vicia faba* L.). Data were collected on seed yield, number of pods per plant, number of seeds per plant, number of seeds per pod, 100 seed weight, number of branches per plant, plant height, leaf area, leaf efficiency and number of days to 50% flowering. Statistical analysis was based on the combined data of the two seasons. No significant difference was detected among genotypes in yield and number of pods per plant while significant differences were observed in numbers of seeds per plant and seed weight. The genotype Selaim Improved differed significantly from other three genotypes in seed weight. Correlation coefficient between seed yield and yield components was obtained. Positive significant correlation was observed between seed yield and number of pods per plant in the genotypes Hudeiba 72, Basabeer and Hudeiba 93. In Selaim Improved the correlation was positive but not significant. Seed yield per plant showed a significant positive correlation with leaf efficiency in the four genotypes. It can concluded that number of pods and leaf efficiency each of them can be used as selection criterion>

Key wrods:

Introduction

Seed yield is a complex character that is determined by many yield components or related parameters, Kambal [11] and Yassin [21]. Rowland [16] reported that the primary yield components, those which affect the yield directly, were number of pods per plant, number of seeds per pod and seed size. The primary components were also influenced by a number of secondary components such as first flowering node, number of nodes, plant height, and number of branches per plant.

It is very important for a plant breeder working on a breeding program, oriented to yield increase, to determine the yield structure of the crop under study and the interrelationship between seed yield and yield components and to stress on those components having greatest influence on seed yield. The importance of determining the yield structure was related to the low heritability of yield and to the high impact of the environment on yield, [21].

The selection based on yield alone is less efficient due to its complexity and its dependence on many yield components, [18,19]. The direct selection was also ineffective due to the large environment-genotype interaction [9,21].

Other investigations showed the failure of yield primary components as selection criteria yield due to compensation for each other and improvement in one of them may lead to the deterioration of the other, John and Schmidet [9] in winter wheat and Adams [2] in field beans.

The most common approach to tackle this obstacle is to quantify yield by breaking it into readily measurable traits or yield components, [13]. The correlation coefficient which measures the simple linear relationship between characters can be used on this attempt. [19]. It also determines how easy two different traits can be selected together, Kambal, [11].

In faba bean the primary yield components were number of pods per plant, number of seeds per pod and seed weight [16]. Many workers investigated the degree of association between seed yield and yield primary components in faba bean. Positive significant correlation between seed yield and number of pods per plant, in faba bean, was observed by Ibrahim [8], Kambal [11], Sindhu [18], Berhe *et al* [5] and Ulukran [20]

Significant positive correlation was also reported between seed yield and number of seeds per pods by Ibrahim [8], Kambal [11], Magyarosi and Sjodin

Corresponding Author

Ahmed Ali Mohamed Osman, College of Agricultural Studies, Sudan University for Science and technology, Khartoum, Sudan

[12], de Varies [7], Neal and McVerty [13], Sindhu [18], Berhe *et al* [5] and Ulukran [20]. Also positive significant correlation was observed between seed yield and seed weight by Kambal [11], Picard and Perthelem [15] and Nigem *et al* [14].

Among secondary yield component significant positive correlation between seed yield and its component was reported in number of branches per plant by Sandhog [18]. Significant negative correlation was reported between seed yield and plant height by Barakat and Mahdi [4], Abdelmula [1] and Ulukran [20]. Also, significant positive correlation was observed between seed yield and maturity, Abdelmula [1].

The objective of this study to determine the interrelationship between seed yield per plant and yield components and which character can be selected simultaneously with seed yield so as to be used as a selection criterion.

Materials and Methods

This trial was carried out in the Research farm of the College of Agricultural Studies, Sudan University for Science and Technology, Shambat, Khartoum North, latitude 14^o 39´ N and longitude 32^o 31´ E. The trial was replicated for two successive seasons 2002/2003 and 2003/2004.

Four genotypes of faba bean were used in this study; namely, Hudeiba 72, Basabeer, Hudeiba 93 and Selaim Improved. Plots were arranged in a randomized complete block design with four replications. Plot size was 5x3.5 meter with five ridges per plot. Ridges were 0.7 m apart. 2-3 seeds were planted per hole and holes were 0.2 meter apart within the ridge. Blocks were oriented in East-West direction and ridges were in North-South direction. Irrigation water was pumped from the River Nile and applied at 7 days intervals. Weeding was done twice by hand hoe. Samples of 15 plants per plot were selected randomly from the three central ridges. Observations were reported on single plant bases for seed yield per plant, number of pods per plant, number of seeds per plant, number of seeds per pod and 100 seeds weight, number of branches per plant, plant height, leaf area, leaf efficiency and das to 50% flowering.

Analysis of variance was applied for seed yield per plant and its components. The coefficient of variation, CV, was estimated as follows:

CV% = Mean Square of errors/ Grand mean

The least significant, LSD, was used to compare between means according to Adler and Rosller (1961)

The correlation coefficients between seed yield per plant and yield components were calculated according to Adler and Rosller (1961).

Results and Discussion

The average seed yield per plant and its components were shown in Table 1. Analysis of variance showed that the four genotypes were significantly different on average yield per plant. Significant differences were observed on number of seeds per plant and on seed weight. Seed yield per plant is product of these two traits. These results confirmed the results of Kambal [10,11].

Number of seed per plant is the product of number of pods per plant and number of seeds per pod. Both numbers of pods per plant seeds per pod were almost the same on the four genotypes.

Non significant differences among the four genotypes on seed yield per plant, number of pods and number of seeds per pod indicated the narrow range of variability among these genotypes, Table 1.

The relatively higher seed yield per plant over the grand mean was reported in Basabeer was mainly due to the number of pods and number of seeds per pod rather than the seed weight. Table 1.

The determination of the yield structure of a crop and the interrelationship among yield and yield related traits is important for plant breeders. A common approach to facilitate breeding for high yield has been to attempt to further quantify the yield by partitioning it into more readily measurable parts.

Table 1: Average seed yield per plant and its primary components in four genotypes of faba bean

genotype	Yield per plant	Pods per plant	Seeds per plant	Seeds per pod	Seed wt.	No. of branches	Plant height	Leaf area	Leaf efficiency	Days to flowering
Hudeiba 72	30.9	28.5	69.7	2.74	44.1	7.7 a	77.8a	20.0	1.56 a	44.4 a
Basabeer	36.1	25.6	72.9	2.89	49.6	7.2 b	84. b	20.6	1.76 a	42.6 b
Hudeiba 93	32.7	23.7	62.3	2.77	51.6	6.8 b	79.5 a	20.4	1.23 b	43.8 ab
Selaim	31.7	21.5	53.3	2.86	60.4	7.7 a	80.3 c	21.5	1.25 b	44.1 a
LSD (0.05)			6.8**		8.5*	0.6	3.2	.	0.29	0.9
C.V. %	11.28 M	24.1 M	64.5 M	2.74 L	14.98 M	8.11 L	38.1 L	15.53 M	21.38 H	2.71 L

** Significant at 5% level of significance.

* Significant at 1% level of significance.

In this connection, correlation studies are of interest because they indicate the relative ease with which the different characters can be selected together. In faba been and other food legumes, according to Rowland [16] and Cakmakci [6]. The seed yield per plant is usually expressed as:

Seed yield = number of pods per plant X number of seeds per pod X seed weight

As reported by Rowland [16] these were the primary yield component i.e. those components which affect the yield directly.

Table 2: The correlation Coefficient between Seed Yield and Yield Components for Four Genotypes of Faba Bean.

Correlated characters	Genotypes			
	Hudeiba 72	Basabeer	Hudeiba 93	Selaim
Pods/plant	0.625*	0.782**	0.620*	0.390
Seeds/plant	0.628	0.758	0.508	0.477
Seeds/pod	0.233	-0.136	-0.398	0.353
Seed wt.	-0.173	0.393	0.257	0.003
Number of branches	-0.369	0.069	0.104	0.085
Plant height	0.479	0.196	-0.005	-0.412
Leaf area	-0.459	0.217	0.340**	0.022
Leaf efficiency	0.928**	0.940**	0.944**	0.719**
Days to floweing	-0.580	-0.569	-0.283	-0.149

** Significant at 5% level of significance.

* Significant at 1% level of significance.

The significant positive correlations between seed yield and number of pods per plant in Hudeiba 72 (r=0.625), Basabeer (r=0.782) and Hudeiba 93 (r=0.620) render the number of pods a useful criterion for indirect selection for seed yield per plant. The significant positive correlation between seed yield and number pods confirmed the results, obtained by Ibrahim [18], Kambal [11], Nigem el al [14], Berhe *et al* [5], and Ulukran [20] in faba been; Siddique *et al* [17] in narbon bean and Cakmakie [6] in common vetch.

The non significant correlation between the seed yield and the seed weight obtained in this study -0.173, 0.393, 0.257 and 0.003 in Hudeiba 72, Basabeer, Hudeiba 93 and Selaim Improved respectively disagreed with the results obtained by Picard and Parthelon [15] and Nigem *et al* [14]. The non significant correlation between seed yield per plant and its primary components of number of seeds per pod and seed weight was due to ability of yield primary components to compensate each other and therefore an improvement in one of them will lead to the decrease in the other components. It also indicated that number of seeds per pod and seed weight are of low predictive value to seed yield per plant.

The different behaviour of Selaim Improved compared to other three genotypes may be due to that Selaim Improved was recommended to the Northern State where the growing season is longer and cooler than in Central Sudan. The entire three primary yield components showed no significant correlation with seed yield and they cannot be relied on as selection criteria in Shambat environment.

Conclusion:

The correlation coefficient analysis showed that number of pods may be used as a criterion for selection for superior genotype in Hudeiba 72, Basabeer and Hudeiba 93. Or yield per plant and number of pods can be selected together.

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