Performance evaluation of released faba bean varieties at Ankober

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Abstract

Fourteen released and one local faba bean varieties were evaluated for two years at Ankober so as to select adaptable and high yielding varieties for the drained soils of high altitude areas in North Shewa. The experimental design was RCBD with three replications. The combined analysis of variance over the two years showed no significant interaction between variety and year for all the characters except for hundred seed weight. Varieties Gebelcho, Walki, Degaga and Moti gave the highest seed yield of 4536.9, 4450.2, 4358.5 and 4351.4 kg ha-1, respectively, and had the respective yield advantage of 17.44%, 15.20, 12.82, and 12.64% over Ankober local. The same varieties had the respective hundred seed weights of 64.4, 50.0, 43.4, and 63g while Ankober local had 38.5 g. Therefore, considering the importance of diversifying varieties to avoid the risk of relying only on one variety (local variety) and based on seed yield, hundred seed weight and biomass yield as the major selection criteria, respectively Gebelcho and Walki are recommended for production on the well drained brown soils of Ankober and similar environments.

Key words: Faba bean, released varieties.

Introduction

Grain legumes are important components of various farming systems in many parts of the world. Legumes are enjoying a resurgence in interest and an enhanced level of consumption as sole protein source due to an outrageous increase in local prices of animal products, which was also a consequence of a steep decline in both real income and purchasing power of people in most African countries in the 1980s (Nwokolo,1996). In Ethiopia also pulses serve as major source of protein for the bulk of the population and have the capacity to fix atmospheric nitrogen and improve soil fertility (Yohannes, 2000). Among pulse crops in Ethiopia, faba bean is the major one and contributes not only to the incomes of more than 3,841,587 smallholders and in nutritional terms to all residents in highland, mid-highland and urban areas of the country, but also serves as break crops for cereal crops. The crop serves as a source of cash to the farmers and generates foreign currency to the country (Gemechu *et al.*, 2006;

Gezahegn and Dawit, 2006). In Ethiopia, Amhara Region ranks first in terms of faba bean area coverage and production in 2008/09 main cropping season (CSA, 2009). However, its productivity has been low in farmers' fields (1.0-1.4 tone ha^{-1}). The low productivity is largely attributable to the lack of high yielding varieties having tolerance to diseases, insect pests and to stress environments like waterlogging. This study was carried out, therefore, to evaluate the adaptability and productivity of nationally and regionally released faba bean varieties so as to select and recommend for production in the drained soils of high altitude areas like Ankober and similar areas in North Shewa.

Materials and methods

The experiment was conducted in the year 2007 (on-station) and 2008 (on-farm) at Ankober ($9^0$38" N latitude and $39^0$44" E longitude with an altitude of 3140 m above sea level), representing drained brown soils of high altitude areas in North Shewa. According to the unpublished data of the National Meteorology Agency of Ethiopia, Ankober had twenty years average annual rainfall of 1793 mm and the respective maximum and minimum temperatures of 27.35 and 13.04 ^{0}C. A total of 15 nationally and regionally released varieties with the local check from Ankober were included in the study (Table 1). A randomized complete block design with three replications was used. Each plot had four rows with the spacing of 40 cm between rows and 5 cm between plants in each of 4 m long rows. Sowing was done on 13 July 2007 and 24 June 2008. DAP fertilizer at the rate of 100 kg ha^{-1} was applied at sowing. Data on seed and biomass yields, hundred seed weight, plant height, days to 50% flowering, days to 100% maturity, number of seeds per pod, and number of pods per plant were recorded. Seed yield was taken only from the central two rows of each plot after discarding border rows. Analysis of variance for each location and combined analysis of variance over years were done following the standard procedure given by Gomez and Gomez (1984) using the SAS statistical package version 9.00 (SAS Institute INC., 2004). Variance ratio test for homogeneity of variance was carried out to determine the validity of the individual experiment for combined analysis. Combined analysis of variance was performed using PROC GLM procedure. Mean separation was carried out using Duncan's Multiple Range Test at 5% of significance.

Table 1. Specific traits and adaptation areas of released faba bean varieties evaluated in the adaptation trial at Ankober.

Released Varieties	Specific traits	1000 seed weight (g)	Altitude (m)	Reference
Gebelecho	Black root rot disease tolerance	797	1800-3000	MARD (2006)
Degaga	Tolerance to chocolate spot and rust	517	1800-3000	NAIA (2002)
Moti	Tolerance to chocolate spot and rust	781	1800-3000	MARD (2006)
Selale Kasim	Black root rot disease tolerance	346	2100-2700	NAIA (2002)
Wayu	Black root rot disease tolerance	312	2100-2700	NAIA (2002)
NC-58	Tolerance to chocolate spot and rust	449	1900-2300	NSIA (1998)
Mesay	Tolerance to chocolate spot and rust	428	1800-2300	NSIA (1998)
Tesfa	Tolerance to chocolate spot and rust	441	1800-2300	NSIA (1998)
Dagem	Black root rot disease tolerance	330	1800-2800	NAIA (2002)
Holeta-2	Tolerance to chocolate spot and rust	506	2300-3000	NAIA (2001)
CS 20 DK	Tolerance to chocolate spot and rust	476	2300-3000	NSIA (1998)
Bulga-70	Tolerance to chocolate spot and rust	440	2300-3000	NSIA (1998)
Lallo	Black root rot disease tolerance	330	1800-2800	NAIA (2002)
Walki	Black root rot disease tolerance	676	1800-2800	MARD (2008)

Results and discussion

Differences among years were statistically significant for seed and biomass yield, 100 seed weight, number of pods plant^{-1} and plant height (Table 2). There were no differences, however, for number of seeds pod^{-1}. Genotypes also differed significantly in all characters, except number of seeds pod^{-1} (Table 2).

Table 2. ANOVA for the performance of faba bean varieties at Ankober combined over years (2007 and 2008) (mean squares).

Character	Yea r (1)	Variety (14)	Variety x Year (14)	Error (55)
Plant height (cm)	12343.32**	142.81**	47.67ns	36.63
No. of pods per plant	1982.02**	78.87**	29.78ns	16.09
No. of seeds per pod	0.05ns	0.14ns	0.302ns	0.21
100 seed weight (cm)	199.55**	647.78**	39.16**	12.19
Biomass yield (kg ha^{-1})	418778984.7**	5423883.5**	1552123ns	1988018
Seed yield (kg ha^{-1})	63184 374.5**	1 338 796.3**	211548.4ns	369188.2

*, ** and ns denote significant differences at $p \leq 0.05$, $p \leq 0.01$, and non significant difference, respectively. Numbers in parenthesis represent degree of freedom.

Genotype x Year interaction effects were not significant for all characters, except for 100 seed weight indicating the uniformity of the performance of genotypes over years (Table 2).

Significantly taller plant heights were recorded for Degaga, Moti, Gebelecho, Holeta-2, CS-20-Dk and Walki (Table 3). Pods per plant was significantly higher for Dagim, Local variety, Selale, Kasim, Wayu, Degaga, NC-58, Mesay and Lallo (Table 3). Gebelecho and Moti had significantly higher seed size (Table 3). Significantly higher seed yields were recorded for Gebelecho, Degaga, Moti, Bulga-70 and Walki (Table 3). The 100 seed weight advantage of these two varieties over Ankober local was 73.27%, and 34.45%, respectively. In addition, these varieties provided the highest biomass yield as compared to Ankober local.

Table 3. Seed yield and other agronomic characters of faba bean varieties evaluated at Ankober, averaged over 2007and 2008.

Varieties	Plant height (cm)	Pods plant^{-1}	Seeds pod^{-1}	100 seed weight (g)	Bios,	yieln

Seed yield and seed size are economic traits with the first and the second priority as prime objectives of the Ethiopian faba bean breeding program (Asfaw *et al*., 1994b). Therefore considering the importance of diversifying varieties to avoid the risk of relying only on one variety (local variety) and based on seed yield, 100 seed weight and biomass yield as the major selection criteria, respectively Gebelecho and Walki are recommended for production on the well drained brown soils of Ankober and similar environments.

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