Genetic Variation for Yield and some Yield and Growth Traits in Faba Bean (*Vicia Faba* L.) Genotypes in Two Sowing Date

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Abstract

Planting time is crucial in many farming systems because early or late sowing in the growing season expose the crop to drought, adverse temperature, pests and diseases attack. An experiment comprised of 12 treatment combinations, six genotypes (autochthonous landrace from Guilan, Barrakat, France, autochthonous landrace from Lorestan, FILIP3 and FILIP5) and two dates of sowing (1 December 2012 and 2 March 2013) was carried out to determine the effect of planting date on faba bean growth and yield and to estimate genetic parameters for studied traits. The experiment was laid out in a split plot design based on randomized complete block design with three replications. The main plots were sowing date and the sub plots were six faba bean genotypes. Analysis of variance indicated that there were significant effects of planting date, genotype and interaction effects of two factors on all of the studied traits**.** The highest seed yield (3,208 kg/ha), was resulted from sowing on Dec. 1 with the autochthonous landrace genotype from northern Iran. The genotypes in this study exhibited variable yield performances under tow sowing dates. The results of correlation analysis indicate that higher seed yield noticed with sowing in two times can be related to significantly higher number of stems per plant, number of pods per plant, seed length and seed width. High phenotypic coefficient of variation (PCV) was observed for hundred seed weight, number of pods per plant, pod length, seed length and seed width in first sowing date. Broad sense heritability (h^2) was generally high for most studied traits. The genotype 1 (autochthonous landrace from north of Iran) scored the high values of yield per kg ha^{-1} and hundred seed weight in two sowing date, indicating the availability of using it at late planting.

Keywords: Faba bean, genetic advance, heritability, planting date, seed yield

Introduction

Citrus Huanglongbing (HLB) also called citrus The high potential of faba bean (*Vicia faba* L.) to produce seeds with valuable protein and its symbiotic nitrogen fixation ability is the most important advantage of this crop (Sprent and Bradford, 1977). In faba bean, temperature and moisture stress according to different planting date decreases the size and longevity of the foliage, leaf photosynthetic rate, light use efficiency, pod retention and filling by reducing the availability of assimilates and distorting hormonal balance (Manschadi et al., 1998).

Planting time is crucial in many farming systems because early or late sowing in the growing season expose the crop to drought, adverse temperature, pests and diseases attack (Berhe, 1998; McDonald et al., 1994). Late sowing increases the severity of insect and disease attack (McDonald et al., 1994; Sahile et al., 2008) and field emergence and reduced the number of days to flowering, fresh harvest and maturity, green pod length, number of seeds per pod and seed yield (Murabaa et al., 1987). Kawochar et al. (2010) indicated that sowing date had significant influence on yield attributes and yield and the highest values of seed yield was obtained from November 20 sowing time. In a field experiment there were indicated that sowing in second fortnight of July recorded significantly higher growth and yield attributes, green forage and dry matter yield as compared to August first fortnight sowing (Yusufali et al., 2007). Abdelmula and Ishraka (2007) used three sowing dates to evaluation of heat stress on faba bean genotypes and showed that the induced terminal heat stress was severe enough to cause significant reduction in yield and most of the studied traits. Khalil et al. (2010) indicated planting dates significantly affected days to emergence, days to flowering, days to maturity, grains per pod, plant height, and grain yield per ha. Crop planted on October 4, produced maximum grain yield.

Knowledge of the extent of genetic variability for quantitative and quality traits in faba bean and relationships among these would facilitate the breeding improvement of this crop. The low heritability and consequent limited genetic advance for yield in response to selection had led many scientists to search for traits which are associated with yield but which are more highly heritable (De Pace, 1979). Toker (2004) estimated the heritability for seed yield as 62%. Alghamdi (2007) indicated the studied genotypes significantly differed for all of the traits. Hanna and Hayes (1966) showed low heritability for seed yield (0.46). El-Kadi (1968) indicated that the broad-sense heritability were 52.1 % for seed yield. El-Kady and Khalil (1979) revealed that broad-sense heritability estimates were maderate for seed yield. Abo El-Zahab et al. (1980) indicated that heritability values were 21.3% for seed yield. Bora et al. (1998) stated that the high heritability was followed by high genetic advance for fruiting stems per plant, number of pods per plant and seed yield per plant, indicating the scope for their improvement through selection. Ibrahim (2010) indicated narrow-sense heritability was high for 100-seed weight and low for seed yield per plant. Kalia and Sood (2004) revealed high broad-sense heritability estimates (0.97) along with high genetic advance (126%) for pod yield. Mohammed (2003) were recorded the highest heritability and genetic advance for 100-seed weight.

The relationship between seed yield and yield components would be important to breeders for screening breeding materials and selecting donor parents for breeding programs. For instance, some of researchers reported highly correlation between number of pods and seeds per plant and seed yield per plant in faba bean (Bond, 1966). Significant positive phenotypic and genotypic correlations were found for seed yield per plant with number of pod and seeds per plant and harvest index (Mohammed, 2003). In a study, positive and significant correlation coefficients were obtained between number of pods per node with plant height, number of pods per plant and number of nodes per plant (Mulualem et al., 2013). Fikreselassie and Seboka (2011) indicated the existence of sufficient genetic variability for seed yield. Their results also revealed high genotypic coefficient of variation for seed yield and genetic gains that expected from selecting the top 5% of the genotypes, as a percent of the mean, were 35.46% for seed yield. Poulsen and Knudsen (1980) determined positive relationships between seed yield and both seed weight and number of seeds per pod. Ulukan et al. (2003) found the direct and indirect effects of plant height, pod number per plant and seed number per pod on biological yield. A significant and positive correlation was reported between seed yield and plant height, 100-seed weight, seed weight per plant and biological yield, but a negative correlation was determined with maturity date (Alghamdi and Ali, 2004).

Heritability connected to genetic advance has a more important role to play in determining the effectiveness of selection of a trait (Berwal and Khairwal, 1997). The overall performance of a genotype may alter according to changes in environment and the higher values of heritability leads to the simpler the selection process and greater the response to selection (Soomro et al., 2008).

The aim of present research is determination of the variability of traits, provide information on interrelationships of yield and some important of its components and to estimate the genetic parameters such as phenotype and genotype variance, phenotypic and genotypic coefficient of variation, heritability, genetic advance and expected response to selection in two different planting time for some of faba bean genotypes.

Materials and Methods

Experimental Site

This study was carried out during 2012-13 in Shanderman, Guilan province, Iran (longitude, 49° 55´ E; latitude, 37° 27´ N; altitude, 71 m above sea level; climate, wet). Experimental material comprised 6 genotypes of faba bean (*Vicia faba* L.), that some of its features are presented in Table 1.

The experiment comprised of 12 treatment combinations, consisting of six genotypes (Table 1) in subplot and two date of sowing (1 December 2012 and 2 March 2013) in main plot The experiment was laid out in a split plot design with three replications based on randomized complete block design. Each plot consisted of four rows with 6 m long and distance between rows was 50 cm. The seeding rate was 15 plants per m^2. Forty-five-kilogram nitrogen, phosphorus and potassium per hectare were applied as compose fertilizer (15-15-15) prior to sowing. Routine cultural operations were attended to keep the plots free from weeds.

Statistical Analysis

The statistical model was adopted for this experimental design is

$$Y_{ijk} = \mu + \rho_k + (\alpha\rho)_{ik} + \alpha_i + \beta_j + \alpha\beta_{ij} + e_{ijk}$$

Where μ: general mean; α_i: effect of i^{th} factor, genotype, (i = 1, 2, ..., 6); β_j: effect of j^{th} factor, sowing date, (j = 1, 2); ρ_k: effect of k^{th} replication (k = 1, 2, 3); $(\alpha\rho)_{ik}$: main plot error; $\alpha\beta_{ij}$: the interaction effect of i^{th} genotype with j^{th} sowing date; e_{ijk}: experimental error.

The phenotype (σ^2_{ph}) and genotype (σ^2_g) variances were estimated as follows:

$$\sigma^2_g = \frac{(\text{M2 - M1})}{\text{r}} \quad \text{and} \quad \sigma^2_{ph} = \sigma^2_g + \sigma^2_e$$

Where r: number of replications; σ^2_e: error or environmental variance; M1, M2: error and genotype mean squares.

Table 1 Information of faba bean studied genotypes

Genotype	Genotype name	Origin	Breedng status	Seed structure
1	-	North of Iran (Guilan)	Autochthonous Landrace	Large
2	Barrakat	Iran/ Gurgaon	Breeding variety	Large
3	France	France	Breeding variety	Intermediate
4	-	Lorestan (Borujerd1)	autochthonous Landrace	Small
5	FILIP3	Syria	Breeding variety	Small
6	FILIP5	Syria	Breeding variety	Small

Phenotypic (PCV) and genotypic (GCV) coefficients of variation were calculated based on the method supported by Burton (1952) as the following formula:

Phenotypic coefficient of variation (PCV) =

$$\frac{\sqrt{\sigma^2_{ph}}}{\bar{X}} \times 100$$

Genotypic coefficient of variation (GCV) =

$$\frac{\sqrt{\sigma_g^2}}{\overline{X}} \times 100$$

$\overline{X}$ = Grand mean

Heritability percentage in broad sense (h^2) and genetic advance (GA) were estimated according to the method suggested by Johnson et al. (1955) as the following formulas:

$$h^2 = \frac{\sigma_g^2}{\sigma_{ph}^2}$$

$$\text{GA} = \frac{k\sigma_g^2}{\sqrt{\sigma_{ph}^2}}$$

k= selection differential and it was 2.06 as defined by Lush (1949) at selection intensity of 5%.

The expected response to selection (Re) for each trait was calculated as under (Johnson et al., 1955):

$$\text{Re} = k\sqrt{\sigma_{ph}^2}\,h^2$$

Where: k = 1.40 at 20% selection intensity for a trait

Results and Discussion

Analysis of Variance and Genotype's Mean Performance

Analysis of variance indicated that there were significant effects of planting date, genotype and interaction effects of two factors on all of the studied traits (Table is not shown). Because of significance of planting date × genotype interaction effect, the simple effects were calculated for any of sowing date (Sharifi, 2013). The results of analysis of variance for any of sowing dates indicated that the genotypes differed significantly for all of the studied traits exception of day to maturity (DM), number of stems per plant (NStPl) and plant height (PH) (Table 2). Some of researchers indicated there were significant differences between seed yield and yield components in faba bean genotypes (Toker, 2004; Kalla and Sood, 2004; Alghamdi, 2007; Ibrahim, 2010).

Mean comparison for some of important traits were presented in Table 3. The highest seed yield (3208 kg ha^{-1}), as affected by (G x D) interaction, was resulted from sowing on Dec. 1 with the autochthonous landrace genotype from north of Iran. The highest values of seed yield in second planting date were also obtained in this genotype (605.18 kg/ha). The superior values of hundred seed weight were also obtained in this landrace in two planting dates. Breeding variety of Iran (Barrakat) had the highest length of pods in both of planting date season. These traits was markedly affected by (G x D) interaction, where the maximum values were obtained for all of the studied traits in first planting date (1 December 2012). (G x D) interaction had clearly effect on the other traits (the results were not shown). Delayed sowing dates significantly reduced day to flowering (DF), day to maturity (DM) number of stems per plant (NStPl), number of pods per plant (NPoPl), number of seeds per pod (NSePo), dry seed length (LS), dry seed width (SW) and plant height (PH). These results may be reflecting the suitability of this date, in respect to its climatic and local conditions, for germination, emergence and growth. The significant effect of sowing dates was also shown by other workers (Badlwin, 1980; Berhe, 1998; McDonald et al., 1994; Sekara et al., 2001; Yusufali et al., 2007; Abdelmula and Ishraka, 2007 and Kawochar et al., 2010).

The genotypes in this study exhibited variable yield performances and responses under different conditions according to delayed sowing date. The tested genotypes were markedly different in their seed yield in both sowing date seasons. G.1 followed G.3 in the first season, and G.6 in the second one surpassed all other cultivars. In regard to cultivars, the results showed that G.2 produced the longest pod length followed by G.1 and G.3 in two seasons. Genotypic differences for this trait were also recorded by Mokhtar (2001). Different performance among the tested genotypes may be attributed to their differential responses to the environmental factors, which actually depend upon their genetic background.

Table 2 Analysis of variance for some growth and yield characters of faba bean genotypes in first and second planting date

Traits	d1				d2			
	R df=2	G df=5	Error df=10	CV	R df=2	G df=5	Error df=10	CV
SY	91,956.16	917,300.88**	47,974.96	8.43	39,781.33*	82,148.93**	9,629.1	31.440
DF	32.160**	17.800*	3.500	1.84	1.160	3.600**	0.560	1.210
DM	59.050	49.280	24.850	2.84	6.880	4.050	5.950	2.380
HSW	104.380	24,436.22**	83.720	6.86	1,069.380	15,468.22**	679.050	28.810
NStPl	0.370	0.540	0.180	15.85	0.340*	0.056	0.058	20.880
NPoPl	0.120	70.460**	4.070	18.75	0.450	1.770*	0.480	26.750
SL	0.029	1.470**	0.008	4.83	0.020	1.260**	0.015	8.260
SW	0.017	0.604**	0.005	5.52	0.003	0.630**	0.009	8.590
PL	1.950	61.110**	2.460	14.85	2.350*	23.350**	0.510	9.700
NSePo	0.480*	2.470**	0.097	8.07	0.200	1.840**	0.160	0.400
PH	2,121.24**	185.22	166.290	10.63	249.120	111.250	99.950	14.860

Note: * and ** were significant at 5% and 1% level, respectively. CV = Coefficient of variation.
SY: dry seed yield per m^2; DF: day to flowering; DM: day to maturity; HSW: hundred seed weight; NStPl: number of stems per plant; NPoPl: number of pods per plant; PL: pod length; NSePo: number of seeds per pod; LS: dry seed length; SW: dry seed width; PH: plant height.

Table 3 Means of some yield components of faba bean genotypes in first and second planting date

Genotype	d1			d2		
	SY (kg ha^{-1})	HSW (g)	PL (cm)	SY (kg ha^{-1})	HSW (g)	PL (cm)
1	3,208.0^{a}	255.00^{a}	11.03^{b}	605.18^{a}	183.33^{a}	7.76^{b}
2	2,283.5^{d}	237.66^{b}	19.05^{a}	305.52^{b}	180.00^{a}	12.5^{a}
3	3,100.9^{ab}	108.33^{c}	10.03^{bc}	271.82^{bc}	66.67^{b}	7.73^{b}
4	1,718.7^{e}	55.00^{e}	6.03^{d}	126.42^{c}	32.67^{b}	4.95^{c}
5	2,515.3^{dc}	53.33^{e}	7.76^{dc}	200.94^{bc}	31.67^{b}	5.22^{c}
6	2,755.9^{bc}	90.00^{d}	9.56^{cb}	362.28^{b}	48.33^{b}	6.00^{c}
LSD	398.48	16.65	2.86	178.52	47.408	1.3003

Note: The symbols of traits are the same as in Table 2. LSD= Least Significant Difference.

Date of sowing has a significant role on yield since the optimum date of sowing among plants ensures desired growth which determines the yield. The high yield from early planted crop might be due to the fact that early planted crop had longer period for vegetative growth and better utilization of water and nutrients. Moreover late sown crops produced less pods per plant and hence resulted in low yield (Shad et al., 2011). The low yield might be due to cold weather during February and March which hindered the normal growth, photosynthetic and rhizobial activities and the crop did not produce enough leaf area to intercept most of the incoming radiations and convert them to chemical energy through photosynthesis (Kawochar et al., 2010). Moreover, the reduction in yield in late planted crop may be due to poor growth, shorter grain filling duration and maturity period, less number of fruiting nodes and pods per plant and minimum grains per pod (Berhe, 1998; Sahile et al., 2008). Similar findings were observed by Bardossy and Pocsai (1982).

Since the net photosynthesis is dependent on leaf area per plant, higher amounts of photosynthesis might have been produced and attributed for higher forage yield in July second fortnight sowing (Khalil et al., 2010). Significantly superior performance of growth parameters in different growth stages in December sowing was mainly due to longer growth (vegetative) period. These findings are in line with the findings of Bardossy and Pocsai (1982). Changes in plant growth caused by the effects of environmental conditions such as temperature and light intensity were intended to be described by plant growth models (McDonald et al., 1994).

Correlation Coefficients

Positive and significant correlation coefficients were obtained between seed yield and each of number of stems per plant (r = 0.54**), number of pods per plant (r = 0.45*), seed length (r = 0.46*) and seed width (r = 0.45*) in the first sowing date. The results also indicated that seed yield positively correlated with hundred seed weight (r = 0.67**), number of stems per plant (r = 0.49**), number of pods per plant (r = 0.52*), seed length (r = 0.62*), seed width (r = 0.59*) and plant height (r = 0.65**) in the second sowing date. This result indicates the yield of plant is determined by these traits. Negative correlations were observed between hundred seed weight and number of pods per plant (r = -0.530**) in two sowing dates. These results are in agreement with those obtained by Bond (1966); Bianco et al. (1979) and Mohammed (2003). These findings indicate that selection for each or both of number of pods, nodes and biomass would be accompanied by high yielding ability under such conditions. The results of correlation analysis indicate that higher seed yield noticed with sowing in two sowing date can be related to significantly higher number of stems per plant, number of pods per plant, seed length and seed width. (Table 4)

Table 4 Correlation coefficient between seed yield and some growth and yield characters of faba bean genotypes in first (above diagonal) and second (below diagonal) planting date

Traits	SY	HSW	NStPl	NPoPl	SL	SW	PL	PH
SY	1	0.37	0.54**	0.45*	0.46*	0.45*	0.11	0.22
HSW	0.67**	1	0.32	-0.04	0.98**	0.98**	0.75**	0.12
NStPl	0.49*	0.09	1	0.22	0.34	0.35	-0.03	0.59**
NPoPl	0.52*	-0.01	0.48*	1	-0.02	-0.02	-0.23	0.20
SL	0.62**	0.92**	0.04	-0.13	1	0.98**	0.75**	0.14
SW	0.59**	0.91**	0.01	-0.19	0.99**	1	0.75**	0.14
PL	0.26	0.76**	-0.12	-0.43	0.75**	0.79**	1	0.02
PH	0.65**	0.45*	0.43*	0.44*	0.41	0.39	0.32	1

Note: The symbols of traits are the same as in Table 2, * and ** were significant at 5% and 1% level, respectively

Genetic Variability and Heritability

In the present study, high phenotypic coefficient of variation (PCV) was observed for hundred seed weight (67.66%), number of pods per plant (43.91%), pod length (41.93%), seed length (37.36%) and seed width (34.11%) in first sowing date (Table 5). In the second sowing time (Table 5), the high values of PCV were also recorded for 100 seed weight (77.65%), pod length (37.55%), seed length (42.33%) and seed width (41.14%). The remaining traits showed moderate or low PCV in both sowing dates (Table 5 and 6). High genotypic coefficients of variation (GCV) were observed for hundred seed weight, number of pods per plant, pod length, seed length) and seed width in two sowing date (Table 5 and 6). Other researchers such as Bond (1966) and Abul-Naas et al. (1989) reported previously the genetic variance components in faba bean traits such as seed yield, number of pods per plant, 100 seed weight and plant height, played an important role in the total variation. High GCV value of traits suggested the possibility of improving these traits through selection. Low GCV was observed for days to flowering (2.16 and 1.62%), days to maturity (1.63 and 0.78%) and plant height (3.25 and 4.45%) in two sowing date respectively. The Similar results were reported by Mulualem et al. (2013) in faba bean. Moreover, the differences between PCV and GCV were very narrow for all of the studied traits, which indicated the importance of genetic variance in the inheritance of its. In other words, phenotypic coefficient of variation values for most characters was closer than the corresponding genotypic coefficient of variation values showing little environment effect on the expression of these characters.

Table 5 Estimates of values of some of genetic parameters for different characters of faba bean genotypes in first planting date

Traits	Var(G)	Var(Ph)	h^2	PCV	GCV	GA	Re
SY	289,775	292,440.58	0.99	20.82	20.73	2.04	750.19
DF	4.7778	4.97	0.96	2.20	2.16	1.98	3.00
DM	8.1444	9.53	0.86	1.76	1.63	1.76	3.69
HSW	8117.5	8,122.15	1.00	67.66	67.64	2.06	126.10
NStPl	0.1218	0.13	0.92	13.53	13.01	1.90	0.47
NPoPl	22.127	22.35	0.99	43.91	43.69	2.04	6.55
SL	0.4904	0.49	1.00	37.36	37.35	2.06	0.98
SW	0.1996	0.20	1.00	34.11	34.09	2.06	0.63
PL	19.549	19.69	0.99	41.93	41.79	2.05	6.17
NSePo	0.7918	0.80	0.99	23.12	23.05	2.05	1.24
PH	6.3077	15.55	0.41	3.25	2.07	0.84	2.24

Note: The symbols of traits are the same as in Table 2, h^2: heritability; PCV: Phenotypic coefficient of variation; GCV: Genotypic coefficient of variation; GA: genetic advance; Re: response to selection

Heritability (h^2) in broad sense estimates were generally high for most studied traits which ranged from 0.40 for plant height in second sowing date to 1.00 for seed length, seed width in two planting date. The highest estimate of broad sense heritability was recorded by seed yield, DF, DM, HSW, NStPl, NPoPl, SL, SW, PL and NSePo in two sowing dates (Table 5 and 6). High heritability indicated that selection based on mean would be successful in improving these traits. Hence, these traits can be assumed as mainly determined by their genetic constitution. Plant height (0.41) indicated medium heritability including which makes selection for these traits difficult because environmental effect is more evident than genetic effect. Meanwhile, Swarup and Changle (1962) reported that both heritability ratio and GCV% gave the best picture for the expected genetic advance. Those traits that indicated high heritability are found to have high GCV value than traits that showed low heritability. Selection for these traits is relatively easy because most of the variation is genetic rather than environmental. On the other hand, traits with high PCV have less heritability which means variation for these traits is more of environmental than genetic and it is not advisable to select for these traits. Dabholkar (1992) explained that whenever values are stated for heritability of a trait, it refers to a particular population under particular environmental conditions. He classified heritability estimates as low (5 to 10%), medium (10 to 30%) and high (>30%). Accordingly, all the agronomic characters considered for analysis showed high heritability, constituting high breeding value which has more additive genetic effects which is important for crop improvement.

Heritability provides the information on the magnitude of inheritance of traits, while genetic advance is helpful in formulating suitable selection procedures. The information on heritability alone may not help in pointing characters for enforcing selection. Nevertheless, the heritability estimates conducted to predict genetic advance will be more reliable (Mulualem et al., 2013). The results indicated that high estimates of genetic advance were scored for seed yield and yield components of faba bean genotypes in two sowing date seasons.

Conclusion

Sowing on December 1 was led to high performance of seed yield and yield components. Date of planting has a significant role to play in influencing the yield, since the optimum date of sowing among plants ensures desired growth which determines the yield. Planting time is crucial in many farming systems because early or late sowing in the growing season expose the crop to drought, adverse temperature, pests and diseases attack. Successful breeding program depends on the magnitude of genetic variation in the population. Moreover, reliable estimates of genetic and environmental variations will be helpful in estimating the heritability ratio and predicted genetic advance from selection. These estimates are useful to initiate such breeding program in order to improve productivity and quality of the crop. The fraction of the phenotypic variation in a trait that is due to genetic differences can be measured as the heritability of the trait. High estimates of broad sense heritability coupled with higher genetic advance were attained for yield and yield components. High estimates of broad sense heritability coupled with higher genetic advance indicated that these traits were under the control of additive genetic effects for their inheritance and they can be considered as favorable traits for faba bean improvement through selection and this selection should lead to a fast genetic improvement. Genetic variances were greater than environmental variances and heritability was also high with preferred expected selection response, indicated that there are better chances of improvement in faba bean seed yield. The genotype 1 (autochthonous landrace from north of Iran) scored the high values of yield per kg/ha and hundred seed weight in two sowing season, indicating the availability of using it at late planting.

Table 6 Estimates of values of some of genetic parameters for different characters of faba bean genotypes in second planting date

Traits	Var(G)	Var(Ph)	h^2	PCV	GCV	GA	Re
SY	24,173	24,708.25	0.98	50.38	49.83	2.02	215.30
DF	1.0111	1.04	0.97	1.65	1.62	2.00	1.39
DM	0.6333	0.96	0.66	0.96	0.78	1.35	0.90
HSW	4,929.7	4,967.43	0.99	77.95	77.65	2.04	97.92
NStPl	0.0004	0.00	0.12	5.25	1.82	0.25	0.01
NPoPl	0.4316	0.46	0.94	26.09	25.32	1.94	0.89
SL	0.4162	0.42	1.00	42.33	42.28	2.06	0.90
SW	0.2089	0.21	1.00	41.14	41.09	2.06	0.64
PL	7.6163	7.64	1.00	37.55	37.48	2.05	3.86
NSePo	0.5604	0.57	0.98	23.38	23.19	2.03	1.04
PH	3.7667	9.32	0.40	4.54	2.89	0.83	1.73

Note: The symbols of traits are the same as in Table 2. h^2: heritability; PCV: Phenotypic coefficient of variation; GCV: Genotypic coefficient of variation; GA: genetic advance; Re: response to selection

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