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Heritability, Character Relationship and Path Coefficient Analysis in Agronomic Traits of Baby Corn over Different Environments

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Authors' contributions

This work was carried out in collaboration between all authors. Authors MA and SSA designed and executed the study. Authors SB and MMR performed statistical analysis. Author SB wrote the first draft of the manuscript and managed the literature searches. Authors MMR and MA accomplished the analyses on the draft of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Seven hybrids of baby corn (*Zea mays* L.) along with two commercial hybrid baby corn varieties as check were evaluated at six locations in Bangladesh following randomized complete block design with two replications. Close resemblance between genotypic correlation coefficient (GCV) and phenotypic correlation coefficient (PCV) was observed for all traits indicating less interference of environmental effect and thus, the selection for these characters would be effective. Heritability estimates in general were high for all the characters studied except cob length without husk while high heritability coupled with moderate genetic advance as percent of mean was found for cob weight without husk per plant and cob yield per plant. Correlation coefficient analysis showed that for most of the characters, the difference between genotypic correlation coefficient and phenotypic correlation coefficient is low suggesting least environmental influence on these studied traits. Significant positive correlation existed between cob yield per plant with cob length without husk and cob diameter without husk. Path coefficient analysis showed that first cob harvest day, cob length without husk and cob weight with husk per plant exhibited positive direct effect with cob yield per plant. Thus, these traits could be emphasized during selection criteria for improvement of baby corn

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yield. Though number of cob per plant and cob diameter without husk showed negative direct effect on cob yield, indirect effect via upper ear height, lower ear height and interval between first and last cob harvest contributed and they should also be given importance simultaneously during selection.

Keywords: Baby corn; heritability; genetic advance; correlation coefficient and path coefficient.

1. INTRODUCTION

Baby corn is a young cob, collected just after silk emergence and before fertilization. It is eaten as an entire cob in numerous forms (fresh and cooked), and cooking does not change its culinary and fleshly properties significantly. Baby corn production, being a modern expansion has demonstrated as massive efficacious venture in countries like Thailand and Taiwan [1]. Baby corn is an upright option for increasing cropping intensity [2] and it is also suitable to semi-urban agriculture [3]. Being a short duration crop, 3-4 crops of baby corn can be taken in a year, fitting well into the cropping system which is more wanted to farmers [4]. Its cultivation procedure is very easy and more or less same as another corn crop. In Bangladesh, now a day, baby corn is used only in the Chinese restaurant and sell is limited in the super shop. But, amazingly, its demand is increasing day after day. Small-scale farmers can take the opportunity to test the local market. Markets may include sales through local markets, restaurants, local grocery stores, health food stores [5] and even as a street food. If baby corn would become popular as a street food it will be a good source of safe and nutritious food for average income people. From the value-addition point of view, baby corn is used in the preparation of several recipes like soup, raita, pakoras, chutney, pickles sour and sweet, cutlets and so on. Though, baby corn can be used in diversified way but precise study related to breeding strategies is limited [6]. However, being a highly densely populated country, highly crop competition may reject baby corn cultivation unless it is highly productive (4-5 cobs) and nutritious. Usually the presently cultivated baby corn variety produces 1-2 cobs in the country. Recently, we started breeding program of baby corn with >4 cobs. The extent of genetic variability present in the base population of any crop species including baby corn is crucial for crop improvement by plant breeders [7]. Moreover, selection of highly productive cobs needs inter-correlation with different traits of plants. Heritability as well as character association analysis among important traits with economic yield provides important information by observing their association and direct contribution. Though several studies in this area were previously reported, they are mostly experimented in single location. Therefore, this study was undertaken to study genetic variability and character association over locations to generate useful criteria through selecting important traits associated with cob production.

2. MATERIALS AND METHODS

2.1 Materials and Experimental Site

The materials consisted seven locally produced hybrid baby corn viz. BCP 271-9×BCP 271-19 (G1) , BCP 271-12×BCP 271-4 (G2), BCP 271-13×BCP 271-7 (G3), BCP 271-18×BCP 271-6 (G4), BCP 271-18×BCP 271-16 (G5), BCP 271-20×BCP 271-6 (G6) and BCP 271-20×BCP 271-19 (G7) and two commercially used hybrid baby corn varieties, Baby Star (G8) and Hybrid Baby Corn-1 (G9). The experiment was conducted at six locations in Bangladesh viz. Gazipur, Rangpur, Jamalpur, Barisal, Jessore and Hathazari during rabi (winter) 2016-17. The climatic conditions of different experimental sites were presented in Table 1.

2.2 Experimental Design and Agronomic Practices

The experiment was laid out in Randomized Complete Block Design with two replications. Seeds of each entry were sown in 2 rows; 4m long plot maintaining 60 × 25 cm spacing. Seeds were sown in last week of November at all locations. One healthy seedling per hill was allowed after thinning. Fertilizers were applied @ 250, 55, 110, 40, 5 and 1.5 kg/ha of N, P, K, S, Zn, and B respectively. Standard agronomic practices were followed and plant protection measures were taken as when as required for raising a good crop.

2.3 Data Collection

Data was recorded on plant height (PH), upper ear height (UEH), lower ear height (LEH), number of cob per plant (NCP), days to first cob

Table 1. Climatic conditions of six locations in Bangladesh

Location	Ecology				
	Latitude	Longitude	Seasonal rainfall (mm)	Average annual temp. (°C)	Agro-Ecological Zones (AEZ)
Gazipur	24° N	90.43° E	800-1200	25.8	18 (Madhupur Tract)
Rangpur	25.33° N	87.1° E	2169	24.9	2 (Tista Flood Plain)
Jamalpur	24.56° N	89.55° E	1,113.65	26.3	8 (Young Brahmaputra and Jamuna Floodplain)
Barisal	22.79°N	90.29° E	1620-1900	25.9	13 (Ganges Tidal Flood plain)
Jessore	23.17° N	89.20° E	1460-1500	25.7	11 (High Ganges River Flood plain)
Hathazari	22.5° N	91.80° E	2200	25.8	29 (Northern & Eastern Hills)

harvest (DFCH), interval between first and last cob harvest (IFLC), cob length without husk (CL), cob diameter without husk (CD), cob weight with husk per plant (CW), green fodder yield per plant (GFY) and cob yield per plant (CY). At first replication wise all data were recorded at each location. Ten randomly selected plants for each entry at each location were used for collecting data. For measuring cob length without husk (CL), cob diameter without husk (CD), cob weight with husk per plant (CW) and cob yield per plant (CY), average values were calculated from all the cobs per plant where ten randomly selected plants were undertaken for calculation. For assessing green fodder yield per plant (GFY), after dehusking of each cob of each plant, the derivative was also counted with whole green plant weight of the respectively selected plant. Green plant weight was taken immediate after collection of all economic cobs of ten randomly selected plants for each entry.

2.4 Statistical Analysis

The mean value of each character of each genotype over six locations under study were computed and subjected to analysis of variation by using Statistix 10 software. The genotypic, environmental and phenotypic variances were calculated following the method described by Lush [8]. Coefficient of variation for genotype (GCV), environment (ECV) and phenotype (PCV) were calculated as stated by the procedure of Burton [9]. The value of PCV and GCV <10% are classified as low, 10-20% as moderate and >20% as high as suggested by Sivasubramanian and Madhavamenon [10]. Broad sense heritability (H^2), genetic advance (GA) and genetic advance as percent of mean were deliberated as formulated by Johnson et al. [11]. Heritability and genetic advance as percent of mean value categorized as low: < 30%, moderate: 30-60%, high: > 60% and for heritability low: < 10%, moderate: 10-20%, high: > 20% for genetic advance as percentage of mean keeping with the similarity of Johnson *et al.* [11]. The correlation coefficients were performed and partitioned by statistical software SAS (SAS Institute Inc. Cary, NC, USA, version 9.3). Path analysis was carried out using the genotypic correlation coefficient as suggested by Wright [12] and illustrated by Dewey and Lu [13]. The direct and indirect effect of path graded as 0.00-0.09 = negligible, 0.10-0.19 = low, 0.20-0.29 = moderate, 0.30-1.00 = high and more than 1 = very high according to Lenka and Mishra [14].

3. RESULTS AND DISCUSSION

3.1 Comparison of Means

Mean performance of all studied characters of all genotypes over six locations were presented in Table 2. The range of variation for different traits were 158 to 184 cm for plant height (PH), 86 to 110 cm for upper ear plant height (UEH), 50 to 63 cm for lower ear height (LEH), 4.17 to 4.50 for number of cob per plant (NCP), 91 to 96 days for days to first cob harvest (DFCH), 11 to 13 days for interval between first and last cob harvest (IFLC), 8.22 to 9.23 cm for cob length without husk, (CL) 2.87 to 3.17 cm for cob diameter without husk (CD), 209 to 260 g for cob weight with husk (CW), 607 to 691 g for green fodder yield per plant (GFY) and 28.1 to 34.3 g for cob yield per plant (CY).

3.2 Analysis of Variance

The analysis of variance was presented in Table 3. The mean sum of squares for the genotypes was highly significant for all the traits except IFLC, CL and CD which revealed the presence of genetic variability in the materials under studied. Environments mean sum of squares were highly significant for all of the characters. The highly significant effects of environment indicate high differential genotypic response across the different environments. The mean sum of squares for G×E was significant for PH, UEH, LEH, CW, GYPP and CY. The variation in soil structure and moisture across the different environments were considered as a major underlying causal factor for the G×E interaction.

3.3 Estimation of Variance Components, Heritability and Genetic Advance

The estimates of phenotypic, genotypic and environmental variances as well as heritability, genetic advance and genetic advance as percent of mean for the eleven characters in baby corn were presented in Table 4. Crop yield improvement is determined to a large extent by the effective functioning of the crop yield characters [15]. Expression of these characters depends on the overall genetic and environmental factors [16]. Phenotypic variance includes the genotypic and environmental variances. For all characters studied, the phenotypic co-efficient of variation (PCV) was higher than the genotypic coefficient of variation that reveal high influence of environment in the expression of these traits. However, the GCV and PCV for all the studied characters except upper ear height were low that means the variability observed in nine baby corn genotypes is low. The ECV was also low for all studied characters. Therefore, the influence of environment on all characters was low.

Heritability study of a character is important for the breeder since it provides an idea of magnitude of genetic control for the expression of a particular character [17]. Moreover, heritability assists to the consistency of genotypic variability in the selection program and here after regulates its success [18]. Additionally, genetic advance is also vital as it point out the degree of the probable genetic gain from one cycle of selection [19]. In the present study, high heritability was noticed in plant height (94.89%), upper ear height (98.19%), lower ear height (83.91%), days to first cob harvest (70.72%), cob weight with husk per plant (77.72%), green fodder yield per plant (81.46%) and cob yield per plant (87.58%) that revealed variation in these characters was largely controlled by heritable factors. Conversely, low heritability values was exhibited by cob length without husk (22%), presented that it was influenced mostly by environment rather than genetic constitution. Moderately high heritability values for number of cob per plant (35.06%), interval between first and last cob harvest (37.70%) and cob diameter without husk (42.86%) indicated that both genetics and environment played equal roles in the expression of these traits.

The moderate genotypic coefficient of variation for upper ear height (10.37%) indicated that this trait might be further improved through selection. Although, heritability estimates provide the basis for selection on phenotypic performance, the estimate of heritability and genetic advance should always be considered simultaneously, as high heritability alone will not always be trustworthy for selecting the best individual [20]. Estimates of genetic advance help in know-how the type of gene action involved in the expression of various polygenic traits. High values of genetic advance are indicative of additive gene action where as low values are indicative of non-additive gene action [21]. Thus, the heritability estimates will be reliable if accompanied by high genetic advance. In this study, high heritability (98.19%) and high genetic advance as percent of mean (21.17%) observed for upper ear height will go a long way in predicting heritable trait for further improvement. Hence, selection for this trait would prove quite effective since this character seemed to be governed by additive gene action.

On the other hands, characters such as plant height (12.71%), lower ear height (16.91%), cob weight with husk per plant (15.22%), green fodder yield per plant (10.13%) and cob yield per plant (16.35%) showed relatively moderate genetic advance. However, their heritability estimates were high. The presence of high heritability and moderate genetic advance has been reported to suggest the effect of equal contribution of additive and non-additive gene action [22].

Number of cob per plant (3.31%), first cob harvest day (2.86%), interval between first and last cob harvest (7.39%) and cob diameter without husk (4.23%) showed very low genetic advance as percent of mean and moderate percentage of heritability is an indication that non-additive gene action controls these traits and selection would be ineffective. However, high GCV along with high heritability and high genetic advance will provide better information than a single parameter alone [23]. Hence, in this study, upper ear height exhibited moderate GCV (10.37%), high heritability (98.19%) and relatively high genetic advance (21.17%) indicating additive genetic effects and selection could be effective.

Table 2. Mean performance of nine baby corn hybrids for different characters over six locations

Genotype	PH (cm)	UEH (cm)	LEH (cm)	NCP	DFCH	IFLC	CL (cm)	CD (cm)	CW (g)	GFY (g)	CY (g)
G1	175	97	53	4.3	91	13	9.21	2.87	260	631	33.3
G2	184	105	63	4.3	93	13	8.63	2.94	223	691	29.2
G3	175	99	59	4.2	96	12	9.23	2.97	209	666	28.1
G4	161	90	53	4.2	96	12	8.22	2.95	210	643	28.4
G5	162	90	55	4.3	95	13	8.54	3.02	225	628	32.4
G6	158	86	50	4.3	96	12	8.92	3.16	233	608	34.3
G7	165	96	54	4.5	96	12	8.70	3.17	225	607	34.0
G8	177	110	61	4.4	95	11	8.51	3.17	211	669	33.0
G9	178	101	57	4.4	93	11	8.68	2.92	244	648	32.4
Mean	171	97	56	4.3	95	12	8.74	3.02	227	643	31.7
Min	158	86	50	4.17	91	11	8.22	2.87	209	607	28.1
Max	184	110	63	4.50	96	13	9.23	3.17	260	691	34.3
SE	3.06	2.62	1.41	0.04	0.58	0.23	0.11	0.04	5.62	9.47	0.81

PH = Plant height, UEH = Upper ear height, LEH = Lower ear height, NCP = Number of cob per plant, DFCH = Days to first cob harvest, IFLC = Interval between first and last cob harvest, CL = Cob length without husk, CD = Cob diameter without husk, CW = Cob weight with husk per plant, GFY = Green fodder yield per plant and CY = Cob yield per plant

3.4 Correlation and Path Coefficient for Different Traits

Correlations (genotypic and phenotypic) among the studied characters in the present investigation were presented in Table 5. The degree of correlation among attributes will depend on the development of relation between them and on genes which contributes to variation. Positive correlation occurs due to change of gene supplying ancestors. On the other hand negative correlation arises due to competition among the traits for common precursor which is restricted supply [24]. In the present study, genotypic correlation coefficients were more than phenotypic correlation coefficients indicating that the apparent associations are largely due to genetic reasons. Again the difference between genotypic correlation coefficients and phenotypic correlation coefficients were low i.e. these characters were less influenced by the environment. Therefore, the selection on the basis of these studied characters will not mislead us. Genotypic association among traits affecting cob yield elucidate true association as they exclude the environmental influences. The effect of correlation coefficients may not be always fruitful or could give misleading results because the correlation between two variables may be due to third factor. Therefore, it is necessary to analyze the cause and effect relationship between dependent and independent variables to entangle the nature of association between the variables. Path coefficient analysis furnished a method partitioning the correlation coefficient into direct and indirect effect and provides the information on actual contribution of a trait on the yield [13]. In order to understand the true significance of the correlation studies the data were subjected to path coefficient analysis (Table 6).

Plant height (PH) exhibited significant positive correlation with upper ear height (UEH) and lower ear height (LEH) at both genotypic and phenotypic levels (Table 5). Again, plant height (PH), upper ear height (UEH) and lower ear height (LEH) showed highly significant positive correlation with green fodder yield per plant (GFY) at both genotypic and phenotypic levels. On the other hand, these three characters (PH, UEH and LEH) showed insignificant positive correlation with number of cob per plant but significant negative correlation with cob length and cob diameter without husk and ultimately showed insignificant negative correlation with cob yield per plant. Once more, in path coefficient analysis, plant height showed very highly negative direct effect (-1.491) on cob yield per plant (Table 6). Therefore, it can be concluded that tall plant will increase fodder yield but decrease cob yield.

Table 3. Analysis of variance (ANOVA)

Source	df	PH (cm)	UEH (cm)	LEH (cm)	NCP	DFCH	IFLC	CL (cm)	CD (cm)	CW (g)	GFY (g)	CY (g)
Genotype	8	1435**	1224**	334**	0.357	35.83**	10.51	1.63	0.216	4839**	91.77**	16498**
Environment	5	9289**	7782**	6263**	19.59**	487.25**	404.77**	9.80**	355.14**	95248**	1229.51**	302271**
Genotype × environment	40	174.7**	104.9**	64.8**	0.22	5.84	8.13	1.41	0.085	1397*	29.50**	7827**

** $P < 0.05$, ** $p < 0.01$*

PH = Plant height, UEH = Upper ear height, LEH = Lower ear height, NCP = Number of cob per plant, DFCH = Days to first cob harvest, IFLC = Interval between first and last cob harvest, CL = Cob length without husk, CD = Cob diameter without husk, CW = Cob weight with husk per plant, GFY = Green fodder yield per plant and CY = Cob yield per plant

Table 4. Variance, coefficient of variations, heritability, genetic advance, genetic advance as percent of mean and percent of coefficient of variation for all studied traits in baby corn

Characters	σ^2g	σ^2e	σ^2p	GCV	ECV	PCV	H^2 (%)	GA	GA%	CV%
PH	116.7	6.28	122.9	6.33	1.47	6.50	94.89	21.67	12.71	1.14
UEH	101.1	1.87	103.0	10.37	1.41	10.46	98.19	20.52	21.17	1.41
LEH	25.28	4.848	30.13	8.96	3.92	9.78	83.91	9.49	16.91	3.92
NCP	0.014	0.025	0.039	2.71	3.69	4.58	35.06	0.14	3.31	3.69
DFCH	2.445	1.012	3.457	1.65	1.06	1.96	70.72	2.71	2.86	1.06
IFLC	0.483	0.798	1.281	5.84	7.51	9.51	37.70	0.88	7.39	7.49
CL	0.049	0.172	0.221	2.52	4.75	5.38	22.00	0.21	2.44	4.76
CD	0.009	0.012	0.021	3.13	3.62	4.79	42.86	0.13	4.23	3.59
CW	352.6	101.077	453.7	8.38	4.49	9.50	77.72	34.10	15.22	4.49
GFY	1234	280.90	1515	5.45	2.60	6.04	81.46	65.32	10.13	2.60
CY	7.156	1.015	8.171	8.48	3.20	9.07	87.58	5.16	16.35	3.199

6^2g = Genotypic variance, 6^2e = Environmental variance, 6^2p = Phenotypic variance, GCV= Genotypic coefficient of variation, ECV = Environmental coefficient of variation , PCV = Phenotypic coefficient of variation, H^2 = Broad sense heritability, GA = Genetic advance, GAP = Genetic Advance as percent of mean, CV = Coefficient of variation, PH = Plant height, UEH = Upper ear height, LEH = Lower ear height, NCP = Number of cob per plant, DFCH = Days to first cob harvest, IFLC = Interval between first and last cob harvest, CL = Cob length without husk, CD = Cob diameter wihout husk, CW = Cob weight with husk per plant, GFY = Green fodder yield per plant and CY = Cob yield per plant

Table 5. Genotypic (G) and phenotypic (P) correlation coefficient for 11 studied characters in baby corn

Characters	Correlation	UEH	LEH	NCP	DFCH	IFLC	CL	CD	CW	GFY	CY
PH	r_g	0.886**	0.880**	0.163	-0.648**	-0.221	-0.576*	-0.806**	-0.240	0.796**	-0.402
	r_p	0.871**	0.831**	0.158	-0.474	-0.154	-0.165	-0.512	-0.154	0.773**	-0.387
UEH	r_g		0.966**	0.777**	-0.342	-0.534**	-0.759**	-0.587*	-0.557*	0.854**	-0.311
	r_p		0.902**	0.459	-0.252	-0.316	-0.286	-0.323	-0.468	0.797**	-0.293
LEH	r_g			0.592*	-0.199	-0.242	-0.964**	-0.693*	-0.691*	0.951**	-0.569
	r_p			0.354	-0.183	-0.251	-0.374	-0.273	-0.557	0.846**	-0.441
NCP	r_g				0.538	-0.962**	-0.582	0.911**	-1.081	0.361	0.381
	r_p				0.339	-0.169	-0.334	0.042	-0.316	0.168	0.227
DFCH	r_g					0.276	-0.663*	0.830**	-0.552	-0.521	0.186
	r_p					0.030	-0.164	0.480	-0.381	-0.231	0.003
IFLC	r_g						0.201	-0.301	-0.184	-0.029	-0.444
	r_p						-0.110	-0.310	0.082	-0.144	-0.270
CL	r_g							0.202	0.821**	-1.034	0.613*
	r_p							0.193	0.390	-0.293	0.243
CD	r_g								0.166	-1.083	0.907**
	r_p								0.051	-0.511	0.625*
CW	r_g									-0.655*	0.562
	r_p									-0.473	0.497
GFY	r_g										-0.723*
	r_p										-0.667*

** P < 0.05, ** p < 0.01*

PH = Plant height, UEH = Upper ear height, LEH = Lower ear height, NCP = Number of cob per plant, DFCH = Days to first cob harvest, IFLC = Interval between first and last cob harvest, CL = Cob length without husk, CD = Cob diameter without husk, CW = Cob weight with husk per plant, GFY = Green fodder yield per plant and CY = Cob yield per plant

Table 6. Direct (diagonal) and indirect effect of 11 studied characters on cob yield of baby corn

Characters	PH	UEH	LEH	NCP	DFCH	IFLC	CL	CD	CW	GFY	Correlation with CY
PH	**-1.491**	1.178	1.610	-0.079	-0.290	0.126	-0.373	0.525	-0.025	-1.584	-0.402
UEH	-1.320	**1.330**	1.768	-0.375	-0.153	0.305	-0.491	0.382	-0.058	-1.699	-0.311
LEH	-1.312	1.284	**1.830**	-0.286	-0.089	0.138	-0.624	0.451	-0.071	-1.892	-0.569
NCP	-0.243	1.033	1.083	**-0.483**	0.240	0.549	-0.377	-0.593	-0.112	-0.718	0.381
FCHD	0.966	-0.455	-0.365	-0.260	**0.447**	-0.158	-0.429	-0.541	-0.057	1.036	0.186
IFLC	0.329	-0.711	-0.443	0.464	0.123	**-0.571**	0.130	0.196	-0.019	0.057	-0.444
CL	0.859	-1.010	-1.764	0.281	-0.296	-0.115	**0.647**	-0.131	0.085	2.057	0.613
CD	1.202	-0.780	-1.268	-0.439	0.371	0.172	0.131	**-0.652**	0.017	2.154	0.907
CW	0.357	-0.740	-1.264	0.522	-0.246	0.105	0.531	-0.108	**0.103**	1.303	0.562
GFY	-1.187	1.136	1.740	-0.174	-0.233	0.016	-0.669	0.705	-0.068	**-1.990**	-0.723
Residual effect = 0.634											

** p< 0.05 , ** p < 0.01*

PH = Plant height, UEH = Upper ear height, LEH = Lower ear height, NCP = Number of cob per plant, DFCH = Days to first cob harvest, IFLC = Interval between first and last cob harvest, CL = Cob length without husk, CD = Cob diameter without husk, CW = Cob weight with husk per plant, GFY = Green fodder yield per plant and CY = Cob yield per plant

Number of cob per plant showed significant negative correlation with interval between first and last cob harvest but significant positive correlation with cob diameter without husk at genotypic level and finally showed positive insignificant correlation with cob yield at both genotypic and phenotypic levels. In path coefficient analysis it showed highly negative direct effect (-0.483) on cob yield but considering both direct and indirect effect ultimate effect was highly positive (0.381). So, it can be said that if number of cob per plant is increased, cob yield will also be increased. The results are in consonance with the findings of [1].

Days to first cob harvest showed significant negative correlation with cob length without husk but significant positive correlation with cob diameter without husk at genotypic level and finally showed insignificant positive correlation with cob yield per plant at genotypic and phenotypic levels. In path analysis it showed high direct effect (0.447) on cob yield. On the other hand, interval between first and last cob harvest showed insignificant negative correlation with cob yield at both genotypic and phenotypic levels. Again in path analysis, it showed highly negative direct effect (-0.571) on cob yield. So it can be concluded that if days to first cob harvest is prolonged cob yield will be increased but if interval between first and last cob harvest is increased cob yield will be decreased.

Cob length without husk and cob diameter without husk showed significant positive genotypic correlation with cob yield per plant at genotypic level. In path coefficient analysis, cob length without husk showed highly positive direct effect (0.647) on cob yield and cob diameter without husk showed highly negative direct effect (-0.652) on cob yield but considering both direct and indirect effect it (CD) exhibited highly positive effect (0.907) on cob yield. Therefore, if cob length and diameter increase cob yield will also be increased.

Cob weight with husk per plant showed insignificant positive correlation with cob yield at genotypic level and also showed positive direct effect (0.103) on cob yield. Those characters directly or indirectly contribute to increase cob yield, the genes controlling these characters may be linked that is, positioned closely together on the same chromosome or being controlled by pleiotropic gene. Therefore, selection for these traits could be used to directly or indirectly increase cob yield per plant.

Green fodder yield per plant showed significantly negative correlations with cob yield per plant at both genotypic and phenotypic levels and in path coefficient analysis also showed very high negative direct effect (-1.990) on cob yield, indicated that increasing green fodder yield per plant lead to reduction in cob yield per plant both genotypicaly and visually.

On the basis of genetic parameters, correlation coefficient and path coefficient analysis number of cob per plant, first cob harvest day, cob length without husk and cob weight with husk per plant were identified as major component and should be given top priority while formulating selection strategy for improvement of yield of baby corn. Chakraborty and Sah [1] also gave emphasis on number of baby corn per plant, weight of baby corn with husk per plant and weight of baby corn without husk per plant as major component for improvement of yield of baby corn that support the present study.

The residual effect was 0.634 (Table 6), which was high and indicated that the studied character contributed only 36.4% to the variability in baby corn yield. It point out that some other characters which have not been studied here, need to be included in the study to find out the cause of variation in baby corn yield.

4. CONCLUSION

This study was carried out to generate useful traits through selecting important traits associated with cob production. As high heritability coupled with moderate genetic advance as percent of mean in cob weight with husk per plant (CW) and cob yield per plant (CY) so selection would be effective for these two characters. From correlation coefficient and path coefficient analysis, number of cob per plant (NCP), days to first cob harvest (DFCH), cob length without husk (CL) and cob weight with husk per plant (CW) could be considered as important criteria in improving cob yield of baby corn.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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