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GENETIC ANALYSIS OF PRODUCTIVITY TRAITS IN BABY CORN

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Summary

Phenotypic and genotypic correlations estimated in 20 diverse cultivars of maize used for baby corn production using data from two years indicated that husked cob yield per plant exhibited significant positive correlation with number of cobs picked per plant, days to last cob picking, fodder yield and biological yield per plant both at phenotypic and genotypic levels. This suggests that baby corn improvement can be achieved by applying indirect selections for these four traits which are highly correlated with the husked cob yield. Path coefficient analysis revealed that five traits viz., days to first cob silking, days to last cob picking, single husked cob weight, husk yield per plant and biological yield per plant at phenotypic level and eight traits viz., number of cobs picked per plant, single husked cob weight, de-husked to husked cob yield ratio per plant, tassel weight per plant, husk yield per plant, biological yield per plant, stalk weight per plant and harvest index at genotypic level exhibited direct positive effect on husked cob yield per plant. Hence, these traits should be given due importance for selecting superior genotypes specifically for baby corn purpose.

सारांश

बेबीकार्न उत्पादन के लिए उपयोग में लाए गए मकई के 20 विविध किस्मों के फीनोटाइपिक तथा जीनोटाइपिक सहसम्बन्ध के आकलन हेतु उपयोग में लाए गए दो वर्षों के आंकड़ों से यह संकेत मिला कि छिलके सहित प्रति पौधा कॉब उपज लेन पर प्रति पौधे तोड़े गए भुट्टों की संख्या, पहले भुट्टे की तुड़ाई के दिनों, चारा उपज तथा प्रत्येक पौधे से प्राप्त जैविक उपज के प्रति फीनोटाइपिक तथा जीनोटाइपिक स्तर पर उल्लेखनीय सकारात्मक सहसंबंध प्रदर्शित किया। इससे यह पता चलता है कि उपरोक्त चार विशेषताओं हेतु अप्रत्यक्ष चयन द्वारा बेबीकार्न में सुधार लाया जा सकता है जो कि छिलके युक्त कॉब के प्रति उच्च सहसम्बन्ध रखते हैं। पाथ कोफिशिएंट विश्लेषण से पता चला कि फीनोटाइपिक स्तर पर पांच विशेषताएं उदाहरणार्थ प्रथम सिल्किंग आने के दिनों, अंतिम भुट्टे को तोड़ने के दिनों, छिलका सहित भुट्टे का भार, प्रति पौधा छिलके की मात्रा तथा प्रति पौधा जैविक उपज तथा आठ विशेषताओं जैसे प्रति पौधे तोड़े गए भुट्टों की संख्या, छिलके सहित एक भुट्टे का भार, बिना छिलकायुक्त फली की तुलना में छिलका रहित प्रति पौधा उपज का अनुपात, प्रति पौधा टसल भार, प्रति पौधा छिलके सहित उपज, प्रति पौधा जैविक उपज, प्रति पौधा डंठल का भार तथा तुड़ाई इंडेक्स ने जीनोटाइपिक स्तर पर छिलके सहित प्रति पौधा उपज पर सीधा सकारात्मक प्रभाव दर्शाया। अतः बेबीकार्न के लिए उत्कृष्ट जीनोटाइप के चयन हेतु इन विशेषताओं पर उचित ध्यान दिया जाना चाहिए।

Introduction

India is emerging as one of the potential baby corn producing countries due to low cost of production and high demand within the country. There is a great potential to earn foreign exchange through export of fresh/canned baby corn and its processed products. Another important point is that baby corn is safe vegetable to eat as it is almost free from residual effects of pesticides as the young cob is rapped with husk and well protected from insect and diseases. Currently, some of the maize cultivars, initially developed for grain purpose are cultivated for baby corn purpose also, necessitating under standing of relationship between various parameters.

Despite great importance of baby corn, very little work has been done pertaining to understanding of inter relationship on correlation and path studies (Koner and Prodhan 2005, Abirami *et al.*, 2007 and Choudhuri and Prodhan 2007). Analysis of productivity traits among popular cultivars is a pre-requisite to initiate systematic selection work aimed at deriving elite lines specifically useful for baby corn improvement (Prodhan et al., 2007; and Satyanarayana et al., 2005).Hence the present investigation was undertaken to study the phenotypic and genotypic correlations and path analysis for productivity traits relevant for baby corn use in the 20 diverse cultivars of maize.

Materials and methods

The material consisted of a set of 20 diverse genotypes of maize comprising of six single cross hybrids, four double cross hybrids, one three way cross hybrid and nine composites (Table 1). The material was obtained from the Directorate of Maize Research, Pusa Campus, New Delhi, and grown in two diverse seasons, *viz., kharif 2007* and *rabi 2007-2008*. The experiment was laid in Randomized Block Design with three replications at the experimental farm of Janta Vedic College, Baraut, Baghpat (Uttar Pradesh). The plot size for each genotype was 3 m X 1.2 m, with two rows of 3 m length, at a spacing of 60 cm between rows and 15 cm between plants. Observations were recorded on 10 randomly selected plants of each genotype in each replication on 20 productivity characteristics pertaining to maturity, economic yield, biological yield etc. Six important productivity traits, viz. husked cob yield per plant, number of cobs picked per plant, plant height, number of days to last cob picking, fodder yield per plant and biological yield per plant were taken to find out phenotypic and genotypic correlation coefficients (Table 2). The estimates of phenotypic and genotypic correlations were worked out by the procedure described by Johnson *et al.* (1955). The path coefficient analysis was done as per the procedure outlined by Dewey and Lu (1959).

Results and Discussion

From the data collected and analyzed for 20 different traits, six important economic yield traits viz., husked cob yield per plant, number of cobs picked per plant, plant height, days to last cob picking, fodder yield per plant and biological yield per plant were used for analyzing inter correlation and interpretation in the present study. Significant differences for all the characters were apparent indicating existence of genetic variability for all these traits in the 20 genotypes used for the study. Results involving 15 combinations among these six characters reflecting phenotypic and genotypic correlations are presented in Table 2.

At phenotypic level, the husked cob yield per plant exhibited significant positive correlation with number of cobs picked per plant, fodder yield per plant and biological yield per plant. Similarly positive and significant correlation was shown by days to last cob picking with fodder yield per plant and biological yield per plant and also by fodder yield per plant with biological yield per plant. Some relationship was manifested at genotypic level also and thus overall trend was seen across both *kharif* and *rabi* seasons. On the other hand, plant height showed non-significant correlation at both phenotypic and genotypic level, though season the values tended to be negative only during the kharif season.

Apart from above general trend for many traits across the seasons at both phenotypic and genotypic levels, some of the associations showed marked differences during the two seasons. For example, husked cob yield per plant and number of cobs picked per plant showed significant negative correlation with plant height both at phenotypic and genotypic level, only during *kharif* season. The corresponding values were positive, but not significant during *rabi* season. Specifically for the *rabi* season also, instances of positive and significant correlations were exhibited for six of the combinations listed in Table 2. These include husked cob yield with days to last cob picking; number of cobs picked per plant with three traits (number of days to last cob picking, fodder yield per plant, and biological yield per plant); and plant height with both fodder yield per plant and biological yield per plant.

This seasonal variation evident in the present findings may be attributed to significant differences for various factors in the two seasons. These results are in general agreement with those of previous workers (Koner and Prodhan, 2005 and Abirami *et al.,* 2007). The present study reveals that improvement in husked cob yield

Table 1. Salient features of genotypes

Genotype	Source/Centre	Main features (Maturity; type of cultivar)
Kiran	PAU, Ludhina	Early ; composite
Parkash	PAU, Ludhina	Early ; single cross hybrid
X 3342	Pioneer Seeds (Pvt. Seed Comp.)	Early ; double cross hybrid
HIM 129	VPKAS, Almora	Early; three way cross hybrid
Vivek hybrid 17	VPKAS, Almora	Early; single cross hybrid
FQH 4567 (Vivek QPM 9)	VPKAS, Almora	Early; single cross hybrid
Vivek hybrid 9	VPKAS, Almora	Early; single cross hybrid
Pargati	GBPUT, Pantnagar	Early; composite
HQPM 1	CCS HAU, Karnal	Late; single cross hybrid
HM 4	CCS HAU, Karnal	Medium; single cross hybrid
BIO-9637	Bio-Seeds (Pvt. Seed comp.)	Late; double cross hybrid
Comp R-2005-2 (Chandramani)	CSAUAT, Kanpur	Early; composite
D 131 (Pant Sankul Makka 3)	GBPUT, Pantnagar	Early; composite
L 201	R.S., Bajaura, CSK HPKVV, Palampur	Early; composite
PRO 311	Bio-Seeds (Pvt. Seed comp.)	Late; double cross hybrid
Seed Tech 2324	Bisco Seed Tech. (Pvt. Seed comp.)	Late; double cross hybrid
Navjot	PAU, Ludhina	Early; composite
Surya	GBPUT, Pantnagar	Early; composite
L 166	R.S., Bajaura, CSK HPKVV, Palampur	Medium; composite
MS Pool C 7	PAU, Ludhina	Late; composite

Table 2. Estimates of Phenotypic (P) and Genotypic (G) correlations among six productivity traits in *kharif* and *rabi*, 2007-08

Character combination	Correlation Coefficient			
	Phenotypic		Genotypic	
	Kharif	*Rabi*	*Kharif*	*Rabi*
Husked cob yield/plant vs. Number of cobs picked/ plant	0.862**	0.947**	0.873**	0.968**
Husked cob yield/plant vs. Plant height	-0.508**	0.235	-0.523**	0.245
Husked cob yield/plant vs. Days to last cob picking.	0.105	0.667**	0.121	0.815**
Husked cob yield/plant vs. Fodder yield/plant	0.435*	0.756**	0.438*	0.761**
Husked cob yield/plant vs. Biological yield/plant	0.475**	0.774**	0.476**	0.779**
No. of cobs picked per plant vs. Plant height	-0.530**	0.048	-0.567**	0.053
No. of cobs picked per plant vs. Days to last cob picking.	-0.117	0.618**	-0.113	0.799**
No. of cobs picked per plant vs. fodder yield/plant	0.108	0.617**	0.110	0.642**
No. of cobs picked per plant vs. Biological yield/plant	0.151	0.640**	0.153	0.665**
Plant height vs. Days to last cob picking	-0.085	0.312	-0.084	0.375
Plant height vs. Fodder yield/plant	0.205	0.614**	0.209	0.619**
Plant height vs. Biological yield/plant	0.180	0.601**	0.182	0.606**
Days to last cob picking vs. Fodder yield/plant	0.455**	0.720**	0.475**	0.854**
Days to last cob picking vs. Biological yield/plant	0.446*	0.728**	0.468**	0.863**
Fodder yield/Plant vs. Biological yield/Plant	0.998**	0.999**	0.999**	0.890**

per plant can be achieved by applying indirect selections for number of cobs picked/plant, days to last cob picking, fodder yield per plant and biological yield per plant.

For path coefficient analysis, husked cob yield per plant was considered as dependent and the remaining 19 productivity traits as independent parameters. Path coefficient analysis measures the cause of association between two variables. In other words it splits the correlation coefficient into the measures of direct and indirect effects estimating the direct and indirect contribution of various independent characters towards a dependent character as presented in Table 3 and 4.

Path coefficient analysis revealed that out of 19 characters only four traits viz. days to first cob silking, days to last cob picking, single husked cob weight, and husk (green sheath) yield per plant exhibited direct positive effects on dependent character husked cob yield per plant during both the seasons and the remaining 15 traits contributed to husked cob yield indirectly via other component traits for phenotypic path coefficient. The maximum positive indirect effects towards husked cob yield per plant were exhibited by

Table 3. Direct and indirect phenotypic effect of 19 productivity traits on husked cob yield/plant in *kharif* and *rabi*, 2007-08

Productivity traits	Direct Effect		Main indirect contributing traits	Correlation with husked cob yield/plant	
	kharif	*rabi*		*kharif*	*rabi*
Days to tasselling	-0.30	-0.014	Husk yield/plant, stalk weight/plant	0.103	0.632**
Days to first cob silking	0.025	0.033	Husk yield/plant, stalk weight/plant	0.083	0.649**
Days to last cob silking	-0.079	0.008	Husk yield/plant, stalk weight/plant	0.082	0.660**
Days to first cob picking	-0.291	-0.162	Husk yield/plant, stalk weight/plant	0.061	0.655**
Days to last cob picking	0.295	0.128	Husk yield/plant, stalk weight/plant	0.105	0.667**
Days to first and last cob picking interval	-0.122	-0.062	Biological yield/plant	0.038	-0.148
Number of cobs picked/plant	0.006	-0.012	Husk yield/plant, stalk weight/plant	0.862**	0.947**
Single husked cob weight	0.002	0.605	Husk yield/plant, stalk weight/plant	0.756**	0.822**
Single de-husked cob weight	0.000	-0.069	Biological yield/plant	-0.102	-0.180
De-husked cob yield/plant	-0.008	0.682	Husk yield/plant, stalk weight/plant	0.810**	0.913**
De-husked to husked cob yield ratio/ plant	0.003	-0.013	-	-	-
Plant height	0.000	0.000	-	-	-
Tassel weight/plant	-0.069	0.583	Husk yield/plant, stalk weight/plant	0.474*	0.427*
Husk weight/cob	-0.001	-0.630	Husk yield/plant, stalk weight/plant	0.680**	0.819**
Husk yield/plant	0.471	5.392	Husk yield/plant, stalk weight/plant	0.988**	0.998**
Stalk weight/plant	1.195	1.914	-	-	-
Fodder yield/plant	-1.577	-2.873	Husk yield/plant, stalk weight/plant	0.435*	0.765**
Biological yield/plant	2.924	2.598	Husk yield/plant, stalk weight/plant	0.475*	0.774**
Harvest Index	-0.013	0.002	Husk yield/plant, stalk weight/plant	0.300	0.124

biological yield per plant during *kharif* season and by husk yield and stalk weight per plant during *rabi* season in majority of cases while by de-husked cob yield per plant and fodder yield in few cases during both the seasons.

Tiwari and Verma (1999) analyzing 28 baby corn genotypes grown during kharif 1997 reported that the genotypic correlation coefficients were in general, similar in direction to the phenotypic correlation coefficients, but higher in magnitude. Baby corn yield was positively correlated with the traits cob yield with husk, ear diameter and fodder yield, but negatively correlated with days to first silk emergence, plant height, ear height and ear length. Path coefficient analysis indicated that cob yield with husk followed by ear diameter made the greatest positive direct contribution to baby corn yield. Days to first silk emergence registered highly negative direct effects on

Table 4. Direct and indirect genotypic effect of 19 productivity traits towards husked cob yield/plant in *kharif* and *rabi,* 2007-08

Productivity traits	Direct Effect		Main indirect contributing traits	Correlation with husked cob yield/plant	
	kharif	rabi		kharif	rabi
Days to tasselling	0.444	-0.006	Husk yield/plant, stalk weight/ plant, Biological yield/plant	0.117	0.681**
Days to first cob silking	-0.508	0.011	Husk yield/plant, stalk weight/ plant, Biological yield/plant	0.098	0.744**
Days to last cob silking	1.027	-0.004	Husk yield/plant, stalk weight/ plant, Biological yield/plant	0.098	0.844**
Days to first cob picking	-0.923	0.143	Husk yield/plant, stalk weight/ plant, Biological yield/plant	0.069	0.739**
Days to last cob picking	-0.335	-0.117	Husk yield/plant, stalk weight/ plant, Biological yield/plant	0.121	0.815**
Days to first and last cob picking interval	-0.369	0.046	Fodder yield/plant	0.054	-0.178
Number of cobs/plant	0.310	0.011	Husk yield/plant, Biological yield/plant	0.873**	0.968**
Single husked cob weight	0.207	0.207	Husk yield/plant, stalk weight, Biological yield/plant	0.777**	0.872**
Single de-husked cob weight	-0.002	-0.016	Fodder yield/plant	-0.145	-0.205
De-husked cob yield/plant	-0.290	0.092	Husk yield, Biological yield/plant	0.829**	0.942**
De-husked to husked cob yield ratio/plant	0.186	0.009	-	-	-
Plant height	-0.058	-0.001	-	-	-
Tassel weight/plant	0.113	0.078	Husk yield/plant, stalk weight, Biological yield/plant	0.488*	0.436*
Husk weight/cob	0.007	-0.215	Husk yield/plant, stalk weight, Biological yield/plant	0.694**	0.864**
Husk yield/plant	1.353	1.487	Husk yield/plant, stalk weight, Biological yield/plant	0.995**	0.999**
Stalk weight/plant	1.694	1.581	-	-	-
Fodder yield/plant	-5.324	-1.969	Husk yield/plant, stalk weight, Biological yield/plant	0.438*	0.761**
Biological yield/plant	3.479	0.028	Husk yield/plant, stalk weight, Biological yield/plant	0.476*	0.779**
Harvest Index	0.048	0.005	Husk yield/plant, stalk weight, Biological yield/plant	0.291	0.097

yield. Viola *et al.* (2003) reported that early silking and harvesting of fresh cobs; greater plant height, cob length, cob weight, cob height, number of cobs per plant and lesser cob girth directly contributed to increased cob yield. Abirami *et al.* (2007) reported in field corn that the weight of the cob contributed to the maximum direct effect to grain yield implying that selection for weight of the cob will be highly effective for the improvement of grain yield.

The present study reveals that five traits viz. days to first cob silking, days to last cob picking, single husked cob weight, husk yield per plant and biological yield per plant) at phenotypic level and eight traits (number of cobs picked per plant, single husked cob weight, de-husked to husked cob yield ratio per plant, tassel weight per plant, husk yield per plant, biological yield per plant, stalk weight per plant and harvest index) at genotypic level contributed directly towards husked yield. Hence, these traits should be given prime importance for selecting superior genotypes for husked cob yield per plant, which is the economic and marketable product for the farmers growing baby corn.

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