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Research Article

GENETIC VARIABILITY AND HERITABILITY STUDIES OF MAIZE IN MON DISTRICT NAGALAND INDIA

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Abstract: Eight numbers of local land races of maize germplasm were collected from different part of Mon district Nagaland and evaluated to identify their varietal performance, periodical sowing time and genetic variability for seventeen quantitative traits under the agro morphological purview at the Instructional Farm, Krishi Vigyan Kendra, Mon (Aboi), Nagaland under upland farming conditions during kharif season 2017. The economic characters of the genotypes MM-7 (24.64 q/ ha), showed maximum yield with late in maturity, on the other hand MM-8 (22.51 q/ ha) genotypes observed moderate yield potential with early in maturity. Highest seed yield (21.68 q/ ha) was also recorded when the crop was planted between10th April to 10th May, irrespective of all the land races and different planting time. Significant inter-genetic differences were recorded for all the characters. The highest estimates of genotypic (GCV) and phenotypic (PCV) coefficients of variation were observed in case of grain yield (28.30% and 27.44%), followed by kernel thickness (23.78% and 21.10%). High heritability (%) coupled with high genetic advance was observed for grain yield (97.00 and 48.88), kernel thickness (89.00 and 42.84), plant height (88.00 and 36.95), kernels per row (87.00 and 31.50). Such high heritability followed by high genetic advance indicates that selection may be effective for improvement of such characters to increase grain yield per plant. Sowing of crop at optimum period is very important non- monetary input in obtaining higher yield. Sowing operation for maize should be also find- out during the month of April first fortnight to May first fortnight of the district.

Keywords: *Maize, Variability, Heritability, Genetic Advance, Yield*

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Introduction

Maize is an important cereal crop of global importance, which belongs to the monocot family Gramineae (Poaceae). Maize is used for human consumption in developing and undeveloped countries and as livestock feed in developed countries; moreover, it is also used as green fodder for livestock. Maize is grown in Central and South America, Africa, Central Europe and Asia. In India, UP, Bihar, Rajasthan, MP, Punjab, HP and north eastern region are the major maize growing states. Maize is of two types, *viz*., flints (with round seeds) and dents (with flat seeds). The flour can be easily made from flints than the dents. Maize has C_4 photosynthetic pathway and is more efficient than C3 plants [1].

Maize (*Zea mays* L.) is the only species in the genus Zea, has its diploid chromosome number 2n = 20. Maize (Zea mays L) is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions. Globally, maize is known as queen of cereals because it has the highest genetic yield potential among the cereals. In Mon district Nagaland maize is the second most important crop after rice. To have a good choice of characters for selection of desirable genotypes under plant breeding programme for higher yield, the knowledge of nature and magnitude of variation existing in available breeding materials, the association of components characters with yield and their exact contribution through direct and indirect effects are of crucial importance. A detailed knowledge of association between quantitative traits is essential for formulating an effective breeding programme in any crop [2,3]. Relatively higher estimates of genotype coefficient of variation along with high heritability suggest that selection can be effective for any traits and any crop [4-6]. An attempt has been made to analyze the magnitude of variation and genetic parameters to find out the effectiveness of selection for different traits in maize at the north eastern region of the Mon district of Nagaland state India.

Materials and Methods

Eight local land races (genotypes) of maize were collected and evaluated during *kharif*, 2017 at the Instructional Farm, Krishi Vigyan Kendra, Mon (Aboi), Nagaland situated at an altitude 607.81mamsl, lying between 26°35' 446" N latitude and 98°58' 030" E longitude under mid altitude areas of Nagaland. The soil is experimental site was sandy loam, 5.1 pH and maximum temperature 26.2 to 32.4°C, minimum is 18.4 to 24.2°C, average relative humidity 88.6% and 1625.2 mm total rainfall received during crop period. The experiment was laid out in Randomized Block Design (RBD) with three replications. Each treatment was grown in 4 m long x 6 rows per plot spaced 45 cm apart. The plant to plant distance was maintained 30 cm by thinning. To take out the observations five competitive plants from each plot were randomly selected for recording of observations on seventeen characters *viz*., plant height (cm), days to 50% silking, days to 50% teaseling, stem diameter (cm), no of cobs/ plant, ear length (cm), ear diameter base (cm), leaves/ plant, leaf length (cm), leaf width (cm), kernel row per ear, no of Kernel per row, kernel length (mm), kernel thickness (mm), 100 seed weight (g), days to maturity and grain yield (q/ ha).The data were statistically analysed using standard methods [7] (Panse and Sukhatme 1975). The heritability and genetic advance were computed using established procedures [8,9].

Results and Discussion

The economic characters of the genotypes MM-7 (24.64 q/ ha), showed maximum yield with late in maturity, on the other hand MM-8 (22.51 q/ ha) genotypes observed moderate yield potential with early in maturity. Highest seed yield (21.68 q/ ha) was also recorded when the crop was planted between 10th April to 10th May, irrespective of all the land races and different planting time [Fig-1]. Similar results reported by Sachan *et al* (2014) [10]. A wide range of variation was observed for all the characters studied [Table-1].

Table-1 *Mean, range, genotypic and phenotypic coefficient of variations for eight quantitative characters in maize*

SN	Characters	Average ± SD	Range		Coefficient of variation		Heritability (%)	Genetic advance
			Min.	Max.	PCV	GCV		
1	Plant height (cm)	181.96 25.45	132.20	204.30	18.95	16.68	88.00	36.95
2	Days to 50% silking	68.93± 3.76	63.00	74.50	5.16	3.87	75.00	9.42
3	Days to 50% teaseling	66.33± 3.92	60.60	71.80	5.24	4.05	77.00	10.10
4	Stem diameter (cm)	2.07± 0.32	1.50	2.50	4.96	2.04	41.00	8.82
5	No of cobs/ plant	1.71± 0.42	1.00	2.10	9.24	3.28	35.00	6.27
6	Ear length (cm)	16.63± 1.82	13.40	19.20	17.20	14.58	85.00	29.06
7	Ear diameter base (cm)	3.74± 0.66	2.40	4.50	10.77	7.55	70.00	14.00
8	Leaves/ plant	12.51± 1.46	10.20	14.40	6.55	4.33	66.00	11.62
9	Leaf length (cm)	67.31± 16.30	39.40	82.30	9.23	3.05	33.00	6.26
10	Leaf width (cm)	6.55± 1.84	4.20	8.60	5.10	3.80	74.00	7.34
11	Kernel row/ ear	13.41± 1.60	10.70	14.40	11.00	8.72	79.00	17.75
12	Kernel/ row	29.34± 7.20	16.40	36.20	17.38	15.12	87.00	31.50
13	Kernel length (mm)	8.74± 2.14	5.80	11.40	11.04	8.76	79.00	17.80
14	Kernel thickness (mm)	3.63± 0.42	3.10	4.10	23.78	21.10	89.00	42.84
15	100 seed weight (g)	29.48± 4.11	21.50	34.40	14.37	11.50	80.00	24.26
16	Days to maturity	128.12± 9.61	110.00	140.00	4.91	4.10	83.00	8.22
17	Grain yield (q/ ha)	20.02± 2.70	16.64	24.64	28.30	27.44	97.00	46.88

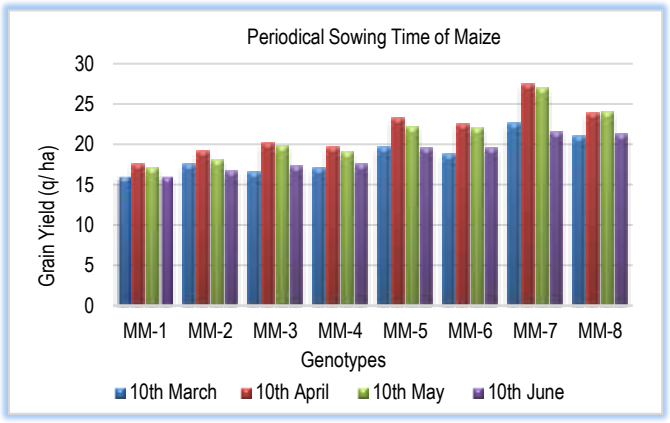

Fig-1 Varietal performance yield (q/ ha) and periodical sowing time of maize genotypes

Significant inter-genetic differences were recorded for all the character. The results pertaining to genetic parameters *viz*., phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability and genetic advance for all the seventeen characters are furnished in [Table-1]. The Highest magnitude of both PCV (28.30%) and GCV (27.44%) were observed for grain yield followed by kernel thickness (23.78% and 21.10%) suggesting that these characters were under the influence of genetic control. Similar reports were earlier given by Reddy and Jabeen (2016) [11] for grain yield. The characters plant height (18.95% and 16.68%), kernel per row (17.38% and 15.12%), ear length (14.37% and 11.50%) and ear length (17.20% and 14.58%) were recorded for moderate magnitudes of both PCV and GCV, respectively. The traits days to maturity (4.91% and 4.10%), stem diameter (4.96% and 2.04%), days to 50% tasseling (5.24% and 4.05%), days to 50% silking (5.16% and 3.87%) and leaf width (5.10% and 3.80%) showed lower magnitudes of both PCV and GCV, respectively. Similar results were reported by Singh *et al*. (2018) [12]; Bekele *et al*. (2014) [13] for days to 50% tasseling indicating the predominance of non-additive gene action. The phenotypic coefficient of variation was higher than genotypic coefficient of variation (GCV) for all the characters under study. The results are in agreement with the findings of Mustafa *et al*. (2014) [14]. Heritability (%) estimates were high for all the traits under study except leaf width (33.00) and cob per plant (35.00) which recorded low estimate of heritability. This suggested the greater effectiveness of selection and improvement to be expected for these characters in future breeding programme as the genetic variance is mostly due to the additive gene action. The results are in consonance with the reports given by Natraj *et al*. (2014) [15] for grain yield per plant, plant height, number of kernels per row, number of kernel rows per ear, ear length, and 100 seed weight. High heritability (%) coupled with high genetic advance was observed for grain yield (97.00 and 48.88), kernel thickness (89.00 and 42.84), plant height (88.00 and 36.95), kernels per row (87.00 and 31.50). Similar results for high heritability and high genetic advance was observed in the same character studied to maize crop were earlier reported by Hepziba *et al*. (2013) [16]. It indicates the role of additive gene action in controlling the traits; hence pedigree method of breeding will be a rewarding one to improve the traits under investigation.

Conclusion

Sowing of crop at optimum period is very important non- monetary input in obtaining higher yield. Sowing operation for maize should be also find- out during the month of April first fortnight to May first fortnight of the district. Selection would potentially be rewarding for improvement of grain yield followed by kernel thickness as the highest GCV was recorded for these characters, which also had a good share of the respective PCV. Further high heritability coupled with high genetic advance were observed for grain yield, kernel thickness, plant height, kernels per row indicate the role of additive gene action in controlling the traits, hence pedigree method of breeding will be a rewarding one to improve the traits under investigation.

Application of research: These land races (genotypes) can be utilized for further breeding programme for development of suitable and promising variety.

Research Category: Genetics & Plant Breeding

Abbreviations: PCV- Phenotypic Coefficient of Variation, GCV- Genotypic Coefficient of Variation

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Study area / Sample Collection: Mon District

Cultivar / Variety / Breed name: Maize Local land races

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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