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Variations in the accessions of Macrotyloma Uniflorum over different locations

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Abstract

Legumes are plants notable for their protein content. Legumes are found to have potential role in controlling several health related problems. *Macrotyloma uniflorum* (Lam. Verdc.), previously known as *Dolichos biflorus* (L.) is a well-known legume profusely grown in areas receiving low rainfall. The genotypes of plants are greatly influenced by the environment in and around which they grow. Genotype X environment interaction or GEI stands for the ranking of various genotypes among locations or years. In the present paper the study was done on fifteen genotypes of *Macrotyloma uniflorum* sown in three different locations for two years. GEI of three morphological characters viz., plant height, seed yield per plant and number of pods per plant is illustrated here. The experiment displayed the variations in data resulted more due to environment than due to genotypic differences.

Keywords: Legumes, profusely, influenced, GEI, displayed, genotypic differences

INTRODUCTION

The plant *Macrotyloma uniflorum* is known commonly as Kulthi in Bengali and horse gram in English. It is a popular legume belonging to the family Fabaceae grown in many parts of India. It is rightly named as Poor Man's Pulse because people inhabiting in adverse climatic conditions can avail its nutritional values due to its wide climatic adaptation. The alarming rate of population rise is a common concern leading to various crop improvement programmes. To meet this requirement promising genotypes are tested each year at several locations and then the most suitable area for high yield is recognized. Most plant breeding programs are beset by the challenge of genotype × environment interaction (GEI) (Simmonds1991). Global climate change has significant effects on environmental conditions and crop production of all crops. Accordingly, environmental factors affecting plant growth and yield should be understood and managed better for more output. Multi-environment yield trails are essential in estimation of genotype by environment interaction and identification of superior genotypes in the final selection cycles (Kaya 2006; Mitrovic 2012). A key objective in agricultural science is to asses and model GEI in order to assist breeding in local environmental changes (Falconer, 1952; Hammer *et al.*, 2006). Some researchers described "yield" as the function of genotype-environment interaction (Arain *et al.*,2011; Balapure *et al.*, 2016).A number of statistical models have been developed in the past to study GEI. Botanists have been helped a lot by these models to sort out the best genotypes from multi environmental trials. The model of Compstock and Robinson (1952) has been chosen for the present study of GEI on Kulthi. The legume was grown in three different locations over two years to understand the role of GEI on this particular plant and select the genotypes that are highly efficient among the locations.

MATERIALS AND METHODS:

Macrotyloma uniflorum (Lam. Verdc.) is a drought prone plant belonging to the family Fabaceae. Horse gram or Kulthi was earlier botanically named as *Dolichos biflorus* (L.). The fifteen genotypes of the legume were acquired from the National Bureau of Plant Genetic Resource (NBPGR), New Delhi. The accessions were IC 89032, IC 203201, IC 139506, IC 561040, IC 267941, IC 385389, IC 49552, IC 392329, IC 320970, IC 145247, IC 9624, IC 24842, IC 341296, IC 22827, IC 139523. In this paper out of these study on only six accessions viz., IC 89032, IC 561040, IC 320970, IC 341296, IC 22827 and IC 139523 are illustrated. The accessions were sown in three different locations of West Bengal, India. The seeds were sown following Randomized Block Design (RBD) in three rows. The spacing between plant to plant and row to row was 25 cm and 30cm respectively. The details of the locations are as under

Location I: Gagnabad, Adra, Purulia.
Location II: Crop Research Farm (CRF), Golapbag, Burdwan.
Location III: Kashipur, Purulia.

Locations I and III belong to the same agro climatic zone whereas location II belongs to a different agro climatic zone. Location II is lesser water deficit zone than the other two.

RESULTS AND DISCUSSION

TABLES

TABLE 1.1: Plant height after 90 days (cm) averaged over k=5 for 15 varieties of *Macrotyloma uniflorum* L. (g x l x y x r data, replication totals and g x l x g totals)

REP	**Location-1**								**Location -2**								**Location-3**							
	Year 1				**Year 2**				**Year 1**				**Year 2**				**Year 1**				**Year 2**			
	I	II	III	∑	I	II	III	∑	I	II	III	∑	I	II	III	∑	I	II	III	∑	I	II	III	∑
1	13.00	10.60	11.30	34.90	6.90	7.25	7.10	21.25	21.80	24.70	22.50	69.00	25.00	24.00	29.60	78.60	18.40	19.65	18.90	56.95	17.95	16.63	16.35	50.93
4	10.90	9.60	9.20	29.70	11.50	8.25	9.50	29.25	21.80	19.70	22.40	63.90	29.60	20.00	26.00	75.60	14.35	15.65	16.80	46.80	12.13	15.75	22.55	50.43
9	9.50	7.00	10.50	27.00	8.10	7.40	7.90	23.40	18.70	27.00	21.00	66.70	15.50	13.00	10.30	38.80	11.50	11.65	14.30	37.45	8.90	10.60	10.78	30.28
13	8.90	9.40	9.50	27.80	6.25	5.40	4.80	16.45	15.60	14.10	12.80	42.50	13.00	10.00	16.00	39.00	9.80	8.40	9.50	27.70	8.50	11.60	11.25	31.35
14	19.50	12.50	17.30	49.30	5.50	6.25	6.00	17.75	9.40	6.30	11.70	27.40	9.00	11.50	7.20	27.70	12.20	10.84	10.10	33.14	14.45	13.70	10.60	38.75
15	12.90	13.25	12.00	38.15	7.00	8.30	5.70	21.00	15.50	13.45	17.70	46.65	14.50	16.25	12.50	43.25	5.15	7.30	7.25	19.70	10.45	10.60	9.00	30.05
∑	74.70	62.35	69.80	206.85	45.25	42.85	41.00	129.10	102.80	105.25	108.10	316.15	106.60	94.75	101.60	302.95	71.40	73.49	76.85	221.74	72.38	78.88	80.53	231.79

TABLE 2.1: Seed yield/plant (g) averaged over k=5 for 15 varieties of *Macrotyloma uniflorum* L. (g x l x y x r data, replication totals and g x l x g totals)

REP	**Location-1**								**Location -2**								**Location-3**							
	Year 1				**Year 2**				**Year 1**				**Year 2**				**Year 1**				**Year 2**			
	I	II	III	∑	I	II	III	∑	I	II	III	∑	I	II	III	∑	I	II	III	∑	I	II	III	∑
1	7.94	8.18	7.64	23.76	8.64	8.60	8.80	26.04	8.62	8.78	8.48	25.88	8.83	8.89	8.63	26.35	7.27	7.41	7.61	22.29	7.54	7.86	7.98	23.38
4	5.92	5.75	6.28	17.95	6.25	5.97	5.95	18.17	6.42	6.41	6.26	19.09	6.25	6.12	6.33	18.70	5.12	5.01	5.31	15.44	5.56	5.41	5.76	16.73
9	6.67	7.11	7.29	21.07	7.36	7.13	6.70	21.19	5.44	5.74	5.83	17.01	5.53	5.90	6.11	17.54	6.33	6.72	6.67	19.72	6.25	6.48	7.07	19.80
13	3.81	3.66	3.51	10.98	3.97	3.86	3.66	11.49	3.63	3.48	3.26	10.37	3.54	3.70	3.32	10.56	4.14	4.27	3.94	12.35	4.01	4.08	4.55	12.64
14	2.37	2.56	2.60	7.53	2.26	2.29	2.43	6.98	2.16	2.02	2.27	6.45	2.02	2.36	2.16	6.54	2.77	2.92	2.67	8.36	2.58	2.61	2.89	8.08
15	2.54	2.65	2.41	7.60	2.20	2.38	2.14	6.72	2.14	2.26	2.31	6.71	1.98	2.05	2.54	6.57	2.95	3.11	2.69	8.75	3.13	3.24	3.29	9.66
∑	29.25	29.91	29.73	88.89	30.68	30.23	29.68	90.59	28.41	28.69	28.41	85.51	28.15	29.02	29.09	86.26	28.58	29.44	28.89	86.91	29.07	29.68	31.54	90.29

TABLE 3.1: No. of pods/plant averaged over k=5 for 15 varieties of *Macrotyloma uniflorum* L. (g x l x y x r data, replication totals and g x l x g totals)

REP	**Location-1**								**Location -2**								**Location-3**							
	Year 1				**Year 2**				**Year 1**				**Year 2**				**Year 1**				**Year 2**			
	I	II	III	∑	I	II	III	∑	I	II	III	∑	I	II	III	∑	I	II	III	∑	I	II	III	∑
1	46.2	47.2	43.4	136.8	49.6	52.2	50.8	152.6	47.4	48.6	44.2	140.2	50.2	51.8	53.2	155.2	41.2	42.4	44.0	127.6	43.2	45.4	46.0	134.6
4	34.0	33.6	36.4	104.0	36.6	35.2	34.8	106.6	35.2	33.0	31.6	99.8	35.6	34.8	36.0	106.4	30.0	29.2	30.8	90.0	32.4	31.4	32.0	95.8
9	38.8	41.0	42.2	122.0	42.8	41.6	39.2	123.6	36.4	39.2	38.6	114.2	38.0	40.0	41.2	119.2	37.0	39.4	38.8	115.2	37.2	38.4	41.4	117.0
13	27.6	26.4	25.6	79.6	29.0	28.4	27.2	84.6	25.2	24.4	23.0	72.6	25.0	25.8	23.6	74.4	29.2	30.2	28.0	87.4	28.8	29.0	32.4	90.2
14	18.4	19.2	20.6	58.2	17.2	17.6	18.4	53.2	17.4	16.4	18.2	52.0	16.6	18.8	17.6	53.0	20.4	21.2	19.6	61.2	18.6	19.2	20.8	58.6
15	14.2	13.8	13.6	41.6	12.4	13.2	11.8	37.4	11.6	12.4	12.6	36.6	10.8	11.6	13.8	36.2	16.4	17.2	15.0	48.6	17.6	18.2	16.4	52.2
∑	179.20	181.2	181.80	542.20	187.60	188.20	182.20	558.0	173.20	174.0	168.20	515.40	176.20	182.80	185.40	544.40	174.20	179.60	176.20	530.0	177.80	181.60	189.0	548.40

Table 1.2: Totals for g, l and g x l (based on Table 15.1)

Variety	Location I	Location II	Location III	∑
IC 89032	56.15	147.60	107.88	311.63
IC 561040	58.95	139.50	97.23	295.68
IC 320970	50.40	105.50	67.73	223.63
IC 341296	44.25	81.50	59.05	184.80
IC 22827	67.05	55.10	71.89	194.04
IC 139523	59.15	89.90	49.75	198.80
∑	335.95	619.10	453.53	

Table 1.3: Totals for y and g x y (based on Table 15.1)

Variety	Year 1	Year 2
IC 89032	160.85	150.78
IC 561040	140.40	155.28
IC 320970	131.15	92.48
IC 341296	98.00	86.80
IC 22827	109.84	84.20
IC 139523	104.50	94.30
∑	744.74	663.84

Table 1.4: Total forl x y (from Table 15.1)

Locations	Year 1	Year 2	Total(l)
I	206.85	129.10	335.95
II	316.15	302.95	619.10
III	221.74	231.79	453.53
Total(y)	744.74	663.84	

Table 2.2: Totals for g, l and g x l (based on Table 18.1)

Variety	Location I	Location II	Location III	∑
IC 89032	49.80	52.23	45.67	147.70
IC 561040	36.12	37.79	32.17	106.08
IC 320970	42.26	34.55	39.52	116.33
IC 341296	22.47	20.93	24.99	68.39
IC 22827	14.51	12.99	16.44	43.94
IC 139523	14.32	13.28	18.41	46.01
∑	179.48	171.77	177.20	

Table 2.3: Totals for y and g x y (based on Table 18.1)

Variety	Year 1	Year 2
IC 89032	71.93	75.77
IC 561040	52.48	53.60
IC 320970	57.80	58.53
IC 341296	33.70	34.69
IC 22827	22.34	21.60
IC 139523	23.06	22.95
∑	261.31	267.14

Table 2.4: Total for l x y (from Table 18.1)

Locations	Year 1	Year 2	Total(l)
I	88.89	90.59	179.48
II	85.51	86.26	171.77
III	86.91	90.29	177.20
Total(y)	261.31	267.14	

Table 3.2: Totals for g, l and g x l (based on Table 21.1)

Variety	Location I	Location II	Location III	∑
IC 89032	289.4	295.4	262.2	847.0
IC 561040	210.6	206.2	185.8	602.6
IC 320970	245.6	233.4	232.2	711.2
IC 341296	164.2	147.0	177.6	488.8
IC 22827	111.4	105.0	119.8	336.2
IC 139523	79.0	72.8	100.8	252.6
∑	1100.20	1059.80	1078.40	

Table 3.3: Totals for y and g x y (based on Table 21.1)

Variety	Year 1	Year 2
IC 89032	404.6	442.4
IC 561040	293.8	308.8
IC 320970	351.4	359.8
IC 341296	239.6	249.2
IC 22827	171.4	164.8
IC 139523	126.8	125.8
∑	1587.60	1650.80

Table 3.4: Total for l x y (from Table 21.1)

Locations	Year 1	Year 2	Total(l)
I	542.20	558.0	1100.20
II	515.40	544.40	1059.80
III	530.0	548.40	1078.40
Total(y)	1587.60	1650.80	

ESTIMATES OF VARIANCE COMPONENTS AND h^2

Table I: ANOVA for G x E interaction in *M. uniflorum*

S.V.	d. f.	MSS		
		X_1	X_2	X_3
r	2	3.14	0.09	2.80
l	2	562.10	0.44	11.36
y	1	60.60	0.31	37.06
l x y	2	57.485	0.05	1.32
g	5	168.794	97.58	2824.80
g x l	10	67.16	1.55	32.72
g x y	5	17.94	0.14	13.27
g x l x y	10	21.841	0.08	1.696
e	70	4.544	0.04	1.715

According to the estimates of variance components and h^2, the calculation of all phenotypic characters was done which has been exhibited in Table II.

Table II: Estimates of variance components and h^2

Estimates	X_1	X_2	X_3
$\sigma^2 g$	3.44	5.32	154.28
$\sigma^2 e$	4.544	0.04	1.715
$\sigma^2 gl$	7.55	0.25	5.17
$\sigma^2 gy$	-0.43	0.07	1.29
$\sigma^2 gly$	5.77	0.013	-0.006
$\sigma^2 p$	6.95	5.44	156.74
$h^2_{B\,S}$	0.49	0.978	0.984

Similarly, the mean performance under G x E interaction of each character over locations year wise were measured for all the fifteen accessions which have been exhibited in following tables {1.5 (A), (B), (C), (D); 2.5 (A), (B), (C), (D); 3.5 (A), (B), (C), (D)}.

Table 1.5: Mean performance under G x E interaction

(A) : g x l means (B) : g x y means

Genotypes	L_I	L_{II}	L_{III}	Y_1	Y_2
IC 89032	9.358	24.600	17.980	17.872	16.753
IC 561040	9.825	23.250	16.205	15.600	17.253
IC 320970	8.400	17.583	11.288	14.572	10.276
IC 341296	7.375	13.583	9.842	10.889	9.644
IC 22827	11.175	9.183	11.982	12.204	9.356
IC 139523	9.858	14.983	8.292	11.611	10.478

(C) : l, y and l x y means

Locations	Y_1	Y_2	Mean
I	11.492	7.172	9.332
II	17.564	16.831	17.198
III	12.319	12.877	12.598
Mean	13.792	12.293	

(D): g and g x l x y means together with CV for genotypes

Genotypes	L_I		L_{II}		L_{III}		Mean
	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	
IC 89032	11.63	7.08	23.00	26.20	18.98	16.98	17.31
IC 561040	9.90	9.75	21.30	25.20	15.60	8.41	15.03
IC 320970	9.00	7.80	22.23	12.93	12.48	10.09	12.42
IC 341296	9.27	5.48	14.17	13.00	9.23	10.45	10.27
IC 22827	16.43	5.92	9.13	9.23	11.05	12.92	10.78
IC 139523	12.72	7.00	15.55	14.42	6.57	10.02	11.05

Table 2.5: Mean performance under G x E interaction

(A): g x l means (B) : g x y means

Genotypes	L_I	L_{II}	L_{III}	Y_1	Y_2
IC 89032	8.300	8.705	7.612	7.992	8.419
IC 561040	6.020	6.298	5.362	5.831	5.956
IC 320970	7.043	5.758	6.587	6.422	6.503
IC 341296	3.745	3.488	4.165	3.744	3.854
IC 22827	2.418	2.165	2.740	2.482	2.400
IC 139523	2.387	2.213	3.068	2.562	2.550

(C): l, y and l x y means

Locations	Y_1	Y_2	Mean
I	4.938	5.033	4.986
II	4.751	4.792	4.772
III	4.828	5.016	4.922
Mean	4.839	4.947	

(D): g and g x l x y means together with CV for genotypes

Genotypes	L_I		L_{II}		L_{III}		Mean
	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	
IC 89032	7.92	8.68	8.63	8.78	7.43	7.79	8.21
IC 561040	5.98	6.06	6.36	6.23	5.15	5.58	5.89
IC 320970	7.02	7.06	5.67	5.85	6.57	6.60	6.46
IC 341296	3.66	3.83	3.46	3.52	4.12	4.21	3.80
IC 22827	2.51	2.33	2.15	2.18	2.79	2.69	2.44
IC 139523	2.53	2.24	2.24	2.19	2.92	3.22	2.56

Table 3.5: Mean performance under G x E interaction

(A): g x l means (B) : g x y means

Genotypes	L_I	L_{II}	L_{III}	Y_1	Y_2
IC 89032	48.233	49.233	43.700	44.956	49.156
IC 561040	35.100	34.367	30.967	32.644	34.311
IC 320970	40.933	38.900	38.700	39.044	39.978
IC 341296	27.367	24.500	29.600	26.622	27.689
IC 22827	18.567	17.500	19.967	19.044	18.311
IC 139523	13.167	12.133	16.800	14.089	13.978

(C): l, y and l x y means

Locations	Y_1	Y_2	Mean
I	30.122	31.0	30.561
II	28.633	30.244	29.439
III	29.444	30.467	29.956
Mean	29.40	30.570	

(D): g and g x l x y means together with CV for genotypes

Genotypes	L_I		L_{II}		L_{III}		Mean
	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	
IC 89032	45.60	50.87	46.73	51.73	42.53	44.87	47.06
IC 561040	34.67	35.53	33.27	35.47	30.00	31.93	33.48
IC 320970	40.67	41.20	38.07	39.73	38.40	39.00	39.51
IC 341296	26.53	28.20	24.20	24.80	29.13	30.07	27.16
IC 22827	19.40	17.73	17.33	17.67	20.40	19.53	18.68
IC 139523	13.87	12.47	12.20	12.07	16.20	17.40	14.04

DISCUSSION

Except year and location x year variances all other variances are significant ($P < 0.01$, i.e. at 1 % level of significance.

(i) Significant location variance – The three environments prevailing at the three locations in the same seasonal time are significantly different. This means, the location means {1.5 (C), 2.5 (C), 3.5 (C)} are highly variant [$L_{II}>L_{III}>L_I$(plant height after 90 days) ; $L_I>L_{III}>L_{II}$(seed yield/plant); $L_I>L_{II}>L_{III}$ (no. of pods/plant)].

(ii) Significant genotype variance – All the six genotypes are significantly different from each other indicating thereby substantial variation among the means {1.5 (D), 2.5 (D), 3.5 (D)} based on mean values of each accession.

IC 89032>IC 561040>IC 320970>IC 139523>IC 22827> IC 341296 (plant height after 90 days)

IC 89032>IC 320970>IC 561040>IC 341296>IC 139523>IC 22827 (seed yield/plant)

IC 89032>IC 320970>IC 561040>IC 341296>IC 22827>IC 139523 (no. of pods/plant)

Thus, in all the locations the best yielder is IC 89032 for the three characters considered.

Among all the three locations the values for the character plant height after 90 days was observed to be highest in location II in most of the genotypes. The seed yield/plant and number of pods/plant values were highest in maximum of the accessions of the crop grown in location I among all the three locations.

Ample variations amongst the genotypes within the years as well as within the same location and different locations are clear from the GEI table.

The effect of environment over the locations and years leads to all these variations in plant height. The presence of GEI has been demonstrated in Table 1.1 (Plant height after 90 days), Table 2.1 (Seed yield/plant) and Table 3.1 (Number of pods/plant) by Comstock and Robinson model (1952). GEI refers to the differential ranking of genotype among locations or years (Fernandez, 1991).When the interaction was partitioned amongst genotypes and locations the variability due to environments was greater than that due to genotypic differences because from the table it is prominent that no genotype stands its highest phenotypic expression all along in either of the locations and years.

Similar observations were obtained by Kaya *et al.* (2002), Admassu *et al.* (2008), (2015), Gauch and Zobel (1996) and Crossa *et al.* (1990).

A series of genotypes are evaluated across locations and over years by breeders before a new genotype is released to be recommended by the worker. Such genotype/variety evaluation trials is a common phenomenon which was followed by so many workers like Kang and Gauch (1996), Asfaw *et al.* (2012), Yan and Kang (2003), Ceccarelli *et al.* (2006), Fernandez

(1991), Magari and Kang (1993), Ebdon and Gauch (2002), Comstock and Moll (1963).

The various statistical models and methodologies have been extensively reviewed and published for the analysis of multi environment genotypic interaction by the workers Lin *et al.* (1986), Becker and Leon (1998), Crossa (1990), Flores *et al.* (1998), Hussein *et al.* (2000), Ferreira *et al.* (2006), Zobel *et al.* (1988) and Yan *et al.* (2007).

Indeed there is no report of GEI on this crop. Lot of publications on this crop has been done by Durga (2012) on its agro morphology, adaptability, genetic variability and divergence. According to Murthy and Arunachalam (1966) the lack of correspondence between genetic diversity and eco-geographic distribution is due to forces other than eco-geographic origin, such as genetic drift, free and frequent exchange of breeding material, variation, natural and artificial selection, and differential gene expression due to genotype-environment interaction.

Plants growing in semi-arid or drought prone areas have several morphological and physiological characteristics in stressful conditions (Kramer, 1983; Tanaka *et al.*, 2010).

The accessions were initially sown in CRF, Burdwan in June, 2011. During this time the vegetative growth of the crop was observed to be higher. Based on the vegetative yield parameters the best accessions were selected for further work. The genotypes were sown in three locations for two cropping seasons i.e. in two years is clear from the Table 1.1. The table also reveals ample variations amongst the genotypes within the years as well as within the same location and different locations.

All these variations of plant height are due to the effect of environment over the locations and years. The presence of GEI has been demonstrated in Table 1.1 (Plant height after 90 days) by Comstock and Robinson model (1952). GEI refers to the differential ranking of genotype among locations or years (Fernandez, 1991).When the interaction was partitioned amongst genotypes and locations the variability due to environments was greater than that due to genotypic differences because from the table it is prominent that no genotype stands its highest phenotypic expression all along in either of the locations and years.

If sown as a fast-developing pioneer, it provides useful early feed in a forage system. Green fodder can be cut as soon as 6 weeks after sowing. However, unless allowed to seed, there is no chance of regeneration in the following year. Grows vigorously in summer, seeds early and then drops its leaves in autumn to early winter. It is best managed as a dry season feed reserve, with the high quality seed-in-pod remaining on the bush, and fallen leaf licked from the ground (Blumenthal *et al.*, 1989,1993; Purseglove, 1974; Smartt, 1990; Van Rensburg, 1967; Verdcourt, 1970, 1980, 1982).

In the Table 2.1 the values for g x l x y x r interactions for the character seed yield per plant are shown.

The phenotypic character number of pods/plant with its g x l x y x r interactions are represented in the Table 3.1.

Samal and Senapati (1997) reported the highest PCV and GCV rate for seed yield per plant in Horse gram. Singh (1994) and Samal (1996) reported high disparities between GCV and PCV for the number of plant branches, but low GCV and PCV for days to 50% flowering on French bean and rice respectively. To estimate the heritability's along with GA as % of mean were reported in soybean by Johnson *et al.* (1955). In terms of horse gram, Venkateswarlu (2000) reported high GA as % of mean for clusters per plant and the number of pods per plant. Dobhal and Rana (1994) also reported that clusters per plant could be improved through phenotypic selection. Genetic variability, character association and their direct and indirect effects on yield are important for crop improvement.

(SwanaLatha *et al.*2016). The moisture content of the fallow land was utilized till harvesting of the crop to minimize the irrigation frequencies. But there was no provision to utilize the moisture content after harvesting the crop due to its seasonal efficiency.

The ideal genotype is the genotype that has the highest yield irrespective to its breeding environment or loses its productivity at minimum level (Sozen *et al.* 2017). However, it should be noted that the trials carried out in different environments do not give always the ideal genotypes for implementing to practice (Yan and Kang, 2003). Tseyaga *et al.* (2012) reported that dry bean yields were significantly affected by genotype and environmental factors, suggesting that these factors should be taken into consideration when evaluating the genotypes. Ideal environment is considered the most determinant factor for Genotype x Environment interaction studies (Choudhary and Haque, 2010).The legume is highly potential in its yield in Purulia besides Burdwan. The data of the different metrical characters showed variations among genotypes as well as locations. The accession IC 89032 proved to be the maximum yield contributor in all the locations among the three characters demonstrated in this paper.

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