International Journal of Agriculture Sciences
ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 10, Issue 19, 2018, pp.-7320-7323.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

GENETIC ANALYSIS OF YIELD AND YIELD ATTRIBUTING CHARACTERS OF SOME GENOTYPES OF GREENGRAM (*Vigna radiata*) DURING SUMMER SEASON IN GANGETIC ALLUVIAL SOIL OF WEST BENGAL

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Received: September 01, 2018; Revised: October 11, 2018; Accepted: October 12, 2018; Published: October 15, 2018

Abstract: The experiment was conducted during Rabi-2016-17 season at RKMVERI, Farm, Narendrapur, Kolkata, West Bengal. The mean values showed significant variation among the genotypes. UTKARSHA has recorded highest no. of seeds per pod (14.00), pod length (10.87 cm) &100 seed weight (5.74g) whereas lowest plant yield was recorded by KM-12-15(5.78g). The phenotypic coefficients of variation (PCV) for all the traits were higher than the corresponding genotypic coefficients of variation (GCV). High heritability along with high genetic advance (% of mean) was recorded for 100 seed weight, number of pods per plant & plant yield indicating that the heritability is due to additive gene effects for controlling the trails & used for further breeding programmes for improvement of these traits. Most of the yield attributing characters showed positive phenotypic & genotypic correlation with plant yield. As per Analysis of Euclidean distance it is clearly seen that the PUSA-0932 and SONALI (2.87) was closely related to each other. Some genotypes showed high percentage of protein. Protein content & total carbohydrate were positively correlated with the yield per plant and the coefficient was high. Based on three RAPD primers genetic diversity was analyzed for all eighteen genotypes. OPA 06 showed high polymorphism (80%) followed by OPA 08 (72.72%) and OPA 03 (50%). Among the eleven clusters, cluster II observed as large one comprising 4 genotypes namely KM-12-46, KM-15-74, KM-15-90 and SM-12-13.

Keywords: Genetic analysis, Summer season, Blackgram

Citation: Raman R.B., *et al*., (2018) Genetic Analysis of Yield and Yield Attributing Characters of some Genotypes of Greengram (*Vigna radiata*) during Summer Season in Gangetic Alluvial Soil of West Bengal. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 10, Issue 19, pp.- 7320-7323.

Introduction

Mungbean belongs to family Leguminoceae and sub-family Papilionaceae. It is the important pulse crop of India cultivated over a wide range of agro climatic zones in the country. This crop is grown in all the season, however maximum area is under Kharif cultivation where intercropping with sorghum, pearl millet, melon, maize, cotton, castor and pigeon pea etc. is also popular. Throughout India, mungbean is used for different purpose. It is utilized in making dal, curries, soup, sweet and vegetarian diets etc. Grain legumes play an important role in meeting the requirements of dietary protein. Pulses are sometimes referred to as the poor man's meat and rich man's vegetable. In India, pulses are the major sources of protein as animal protein being very expensive and are out of reach of majority of people. Pulses are staple diet for the common people of low- and middle-income countries [1]. The pulse protein is rich in lysine and poor in sulphur containing amino acids like methionine and cysteine [2,3]. A reverse situation exists in the cereal proteins. A mixed diet of cereals, vegetables and pulse has therefore a biological value superior to that of either component alone. It is clear that the pulses offer the most practical means of eradicating protein malnutrition especially among children and nursing mother [4]. Keeping in view large benefits of pulses for human health, the United Nations has proclaimed 2016 as the International Year of Pulses [5]. Pulses are important component to sustain the agriculture production as the pulse crops possess wide adaptability to fit into various cropping systems, improve the soil fertility being leguminous in nature and physical health of soil while making soil more porous due tap root system [6].

Materials & Methods

The genotypes for conducting the experiment was collected from Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal & one from R & D Unit of MSSC Ltd., Akola, Maharashtra. Total eighteen number of genotypes were evaluated with three replications in simple RBD design at Instructional Farm of Ramakrishna Mission Vivekananda Educational & Research Institute during summer season. The details of germplasms are as follows

Genotypes	Source
SONALI	AICRP, MULLaRP, B. C. K. V. Mohanpur, Nadia, West Bengal
KM-12-05	AICRP, MULLaRP, B. C. K. V. Mohanpur, Nadia, West Bengal
SAMRAT	AICRP, MULLaRP, B. C. K. V. Mohanpur, Nadia, West Bengal
RM-21-1-2	AICRP, MULLaRP, B. C. K. V. Mohanpur, Nadia, West Bengal
PUSA 0932	AICRP, MULLaRP, B. C. K. V. Mohanpur, Nadia, West Bengal
PUSA 9531	AICRP, MULLaRP, B. C. K. V. Mohanpur, Nadia, West Bengal
SM-12-56	AICRP, MULLaRP, B. C. K. V. Mohanpur, Nadia, West Bengal
KM-12-15	AICRP, MULLaRP, B. C. K. V. Mohanpur, Nadia, West Bengal
IPM-99-125	AICRP, MULLaRP, B. C. K. V. Mohanpur, Nadia, West Bengal
SM-12-28	AICRP, MULLaRP, B. C. K. V. Mohanpur, Nadia, West Bengal
KM-12-39	AICRP, MULLaRP, B. C. K. V. Mohanpur, Nadia, West Bengal
KM-12-13	AICRP, MULLaRP, B. C. K. V. Mohanpur, Nadia, West Bengal
KM-15-19	AICRP, MULLaRP, B. C. K. V. Mohanpur, Nadia, West Bengal
KM-12-57	AICRP, MULLaRP, B. C. K. V. Mohanpur, Nadia, West Bengal
KM-15-90	AICRP, MULLaRP, B. C. K. V. Mohanpur, Nadia, West Bengal
KM-15-74	AICRP, MULLaRP, B. C. K. V. Mohanpur, Nadia, West Bengal
KM-12-46	AICRP, MULLaRP, B. C. K. V. Mohanpur, Nadia, West Bengal
UTKARSA	R & D Unit, MSSC Ltd. Akola, Maharashtra

Data were collected on ten randomly selected plants of each genotypes in three replications to evaluate the yield & yield attributing characters of blackgram. The characters under studies were Days to 50% Flowering, Number of branches per plant, Number of pods per plant, Number of seeds per pod, Pod length, Plant height(cm), 100 seeds weight(gm), Days to maturity & Yield per plant.

Table-1 The mean values of different yield attributing characters of some genotypes of greengram in summer season

Genotypes	days to 50% flowering	No of branches per plant	No. of pods per plant	No. of seeds per pod	Pod length (cm)	plant height (cm)	100 seeds weight (g)	Days to maturity	plants yield (g)
SONALI	51.3	6.1	21.73	11.6	6.94	42.2	3.38	69.33	5.93
KM-12-05	50	6.8	32.67	12	7.83	41.23	3.09	68.67	8.95
SAMRAT	47.3	6.33	31.33	8.93	6.98	40.1	3.11	68.33	12.9
UTKARSA	49.3	5.93	28	14	10.87	42.63	5.74	67	16.21
RM-21-1-2	48.6	6.17	26.63	10.47	8.87	40.47	4.44	62.67	12.89
PUSA 0932	51.3	5.73	21.7	11.13	6.5	39.63	2.64	68.67	6.22
PUSA 9531	48.6	6.2	24.4	11.73	7.64	42.73	3.44	63	11.16
SM-12-56	49.6	5.4	22.9	9.53	6.73	35.4	2.64	67.33	6.18
KM-12-15	47.6	6.1	19.83	9.53	7.91	43.3	2.63	65.33	5.78
IPM-99-125	49.3	6.5	27.17	9.87	6.95	42.87	3.12	67	7.85
SM-12-28	49.3	6.47	28.17	11.93	7.31	44.97	3.35	66.67	9.27
KM-12-39	46.3	6.37	24.33	9.6	7.67	40.77	3.59	63.67	11.23
SM-12-13	43.6	6.6	26.37	9.87	6.63	43	3.51	62.67	13.17
KM-15-19	46.6	6.17	17.7	10	7.49	44.2	3.65	64.33	6.2
KM-12-57	51.6	7.13	26.97	11.6	7.73	43	3.49	68.67	13.04
KM-15-90	51.6	6.27	20.83	10.87	6.79	35.8	3.42	68.67	7.36
KM-15-74	51	5.83	22.53	9.87	7.64	37.2	4.18	69	12.86
KM-12-46	45.6	6.6	28.07	10.53	7.39	36.23	5.3	62.67	15.9
SE (M)	0.93	0.23	0.5	0.57	0.3	1.08	0.07	1.69	0.62
CV%	2.68	0.67	1.45	1.64	0.87	3.09	0.21	4.86	1.79
CD (P=0.05)	3.3	6.46	3.47	9.21	6.91	4.56	3.6	4.42	10.6

Table-2 Genotypic coefficient variation (GCV), Phenotypic coefficient variation (PCV), Heritability and Genetic advance (%) of mean

Characters	GCV	PCV	h^2	GA(%) of Mean
Days to 50% flowering	4.3619	5.4646	0.6372	7.1724
No of branches/ plant	5.2733	8.3396	0.3998	6.8689
No. Of pods/ plant	15.7825	16.1602	0.9538	31.7521
No. Of seeds/ pod	10.4060	13.8930	0.5610	16.0559
Pod length (cm.)	12.7665	14.5338	0.7716	23.1010
plant height (cm)	6.7279	8.1252	0.6856	11.4758
100 seeds weight (gm)	23.4626	23.7370	0.9770	47.7742
Days to maturity	2.8030	5.2344	0.2868	3.0920
plant yield (gm)	34.1235	35.5976	0.9189	67.3835

Table-3 Euclidean distance matrix

KM-12-46																		0
KM-15-74																	0	10.57
KM-15-90																0	6.18	14.2
KM-12-57															0	11.13	7.69	11.49
KM-15-19														0	13.47	11.26	12.56	16.5
SM-12-13													0	11.74	10.24	14.75	12.01	8.04
KM-12-39												0	4.71	9.04	8.56	10.39	8.34	7.86
SM-12-28											0	7.74	8.67	11.67	5.45	12.35	10.9	12.47
IPM-99-125										0	3.46	6.69	8.94	10.44	6.28	9.99	9.36	12.13
KM-12-15									0	8.08	9.79	7.87	11.11	2.99	11.71	9.52	11.04	15.49
SM-12-56								0	9.05	8.87	11.71	9.15	13.37	11.18	11.67	3.85	7.49	13.02
PUSA 9531							0	10.37	7.88	6.26	6.08	3.79	6.14	8.97	7.23	10.85	9.09	9.61
PUSA 0932						0	9.11	5.16	6.81	7.24	9.49	9.4	13.39	8.99	9.5	4.23	7.49	14.93
RM-21-1-2					0	11.05	4.16	10.8	10.86	7.52	7.62	4.19	6.16	12.16	7.48	11.69	8.66	6.42
UTKARSA				0	7.41	13.87	8.71	15.04	14.83	10.5	8.76	9.81	10.16	15.96	6.45	14.72	10.36	9.9
SAMRAT			0	9.06	7.99	12.62	9.83	12.1	14.28	7.56	7.93	8.72	8.93	16.3	7.41	13.5	10.12	8.77
KM-12-05		0	6.02	10.04	9.8	11.6	10.49	12.19	14.23	6.54	6.26	10.94	11.95	16.59	7.46	13.33	11.92	12.51
SONALI	0	11.55	13.02	13.47	11.53	2.87	9.08	7.73	6.33	6.81	8.47	9.33	13.45	8.36	8.99	6.7	8.84	16.03
	SONALI	KM-12-05	SAMRAT	UTKARSA	RM-21-1-2	PUSA 0932	PUSA 9531	SM-12-56	KM-12-15	IPM-99-125	SM-12-28	KM-12-39	SM-12-13	KM-15-19	KM-12-57	KM-15-90	KM-15-74	KM-12-46

In present experiment, protein estimated by Lowry (1951) method carbohydrate by Anthrone method [7].

Results & Discussions

The mean values of seed yield per plant and different yield attributing characters of the eighteen lines were presented in Table-1. Among the eighteen lines UTKARSHA recorded highest yield per plant (16.21g) followed by KM-12-46 (15.90g) & SM-12-13 (13.17g). UTKARSHA has also recorded highest no. of seeds per pod (14.00), pod length (10.87 cm) & 100 seed weight (5.74g) whereas lowest plant yield was recorded by KM-12-15 (5.78g). Highest number of pods per plant was recorded by KM-12-05 (32.67) followed by SAMRAT (31.33) whereas lowest no. of pods per plant were recorded by KM-15-19 (17.70). Highest 100 seed weight were recorded by UTKARSHA (5.74g) followed by KM-12-46 (5.30g) whereas lowest 100 seed weight were recorded by KM-12-15 (2.63g). In the present studies, the phenotypic coefficients of variation (PCV) for all the traits were higher (Table-2) than the corresponding genotypic coefficients of variation (GCV). Similarly, the higher PCV were also reported by Rohman *et. al.*, (2003) in Greengram & Khan *et. al.* (2015) in Cowpea [8,9]. The difference between PCV and GCV were less for 100 seed weight (23.73 & 23.46), no. pods per plant (16.16 & 15.78), days to 50% flowering (5.46 & 4.36) & plant yield (35.59 & 34.12) whereas difference of PCV & GCV were more for number of seeds per pod (13.89 & 10.21) & number of branches per plant (8.33 & 5.27). Heritability in broad sense along with genetic advance (% of Mean) was recorded for all the characters in Table-2. The characters such as 100 seed weight (0.97), number of pods per plant (0.95), plant yield (0.91) & pod length (0.77) showed higher heritability estimates than other characters while plant height (0.68) & days to 50 % flowering (0.63) showed moderate heritability estimates than other characters. The characters like plant yield (67.38), 100 seed weight (47.77) & number of pods per plant (31.75) were recorded higher genetic advance (% of Mean) than other characters. In the present study high heritability along with high genetic advance (% of mean) was recorded for 100 seed weight, number of pods per plant & plant yield indicating that most likely the heritability is due to additive gene effects for controlling the trails & used for further breeding programmes for improvement of these traits. Similar results were found by Rohman *et al.*, (2003) in greengram & Pandit *et al.*, (2009) in bottlegourd [10-14].

Analysis of Euclidean distance

This study was done to check the variability among the eighteen selected genotypes on the basis of nine morphometric characters presented in Table 3. Maximum similarity was found between PUSA-0932 and Sonali (2.87) followed by KM-15-13 and KM-12-15 (2.99), PUSA-9531 and KM-15-19 (3.79), SM-12-56 and KM-12-57 (3.85). Maximum dissimilarity was observed between SM-12-13 and KM-12-05 (16.59), followed by SM-12-13 and KM-12-46 (16.50), SM-12-13 and Samrat (16.30), UTKARSA and KM-15-19 (1044.4), Sonali & KM-12-46 (16.03). Protein content ranged from 15.12% to 25.62%. KM-15-19 recorded maximum protein content followed by SM-12-28 (25.56%) & UTKARSA (23.5%) where as KM-12-46 recorded maximum followed by IPM-99-125 (53.16%) & KM-12-05 (52.87%).

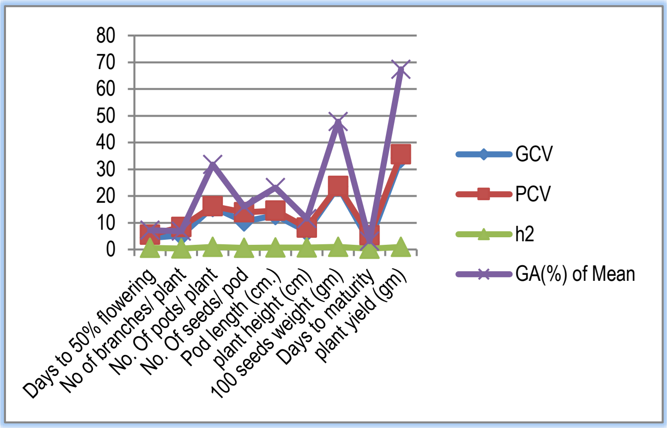

Fig-1 Graphical representation of GCV, PCV, Heritability & Genetic Advance

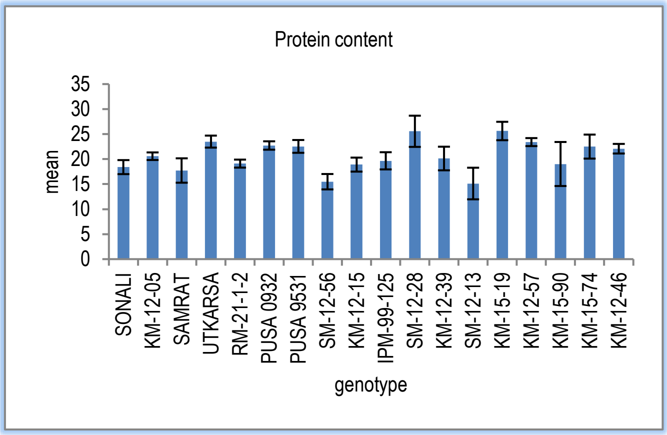

Fig-2 Protein Content

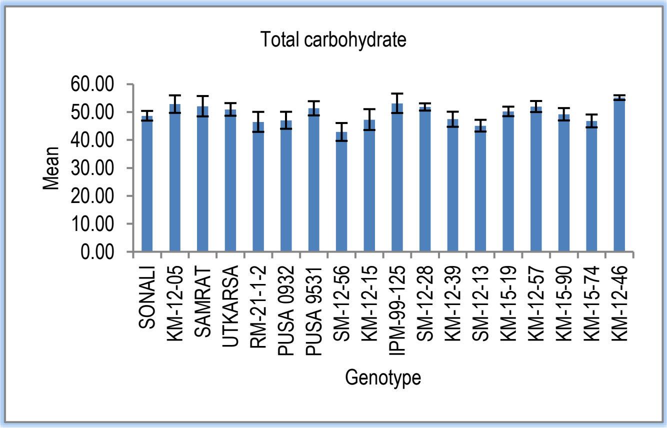

Fig-3 Total carbohydrate

Correlation of protein & carbohydrate on seed yield per plant showed that protein content was positively correlated with the yield per plant and the coefficient was high (0.614). Total carbohydrate content was also positively correlated with yield per plant but coefficient was low (0.216).

	Protein	Carbohydrate	Yield/plant
Protein	1.00		
Carbohydrate	0.027	1.00	
Yield/ ha	0.614	0.216	1.00

Cluster analysis of 18 selected green gram genotypes by RAPD markers

10 RAPD primers were selected at first but 3 of them were finally screened because they gave the amplification for all 18 genotypes. Based on those 3 RAPD primers genetic diversity was analysed of the genotypes. OPA 06 showed high polymorphism (80%) followed by OPA 08 (72.72%) and OPA 03 (50%).

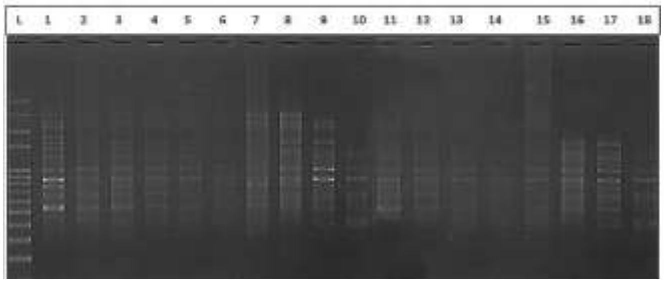

Fig-4 Gel profile18 greengram genotypes (1-18 with ladder) based on RAPD primers (OPA 08)

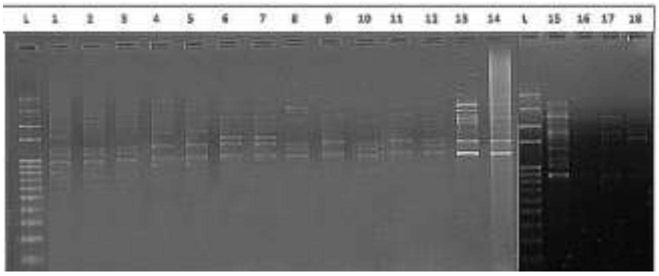

Fig-5 Gel profile18 greengram genotypes (1-18 with ladder) based on RAPD primers (OPA 06)

It is very clear that there was a wide range of diversity among 18 genotypes. 11 clusters were found to this dendrogram considering the Jacquard coefficient. There was only one large cluster, which was cluster II, comprised by 4 genotypes namely KM-12-46, KM-15-74, KM-15-90 and SM-12-13. Among them SM-12-13 singly formed one sub cluster and others formed another cluster. PUSA 9531 and PUSA 0932 were 94% similar followed by the similarity of 88% in between KM-12-46 and KM-15-74.

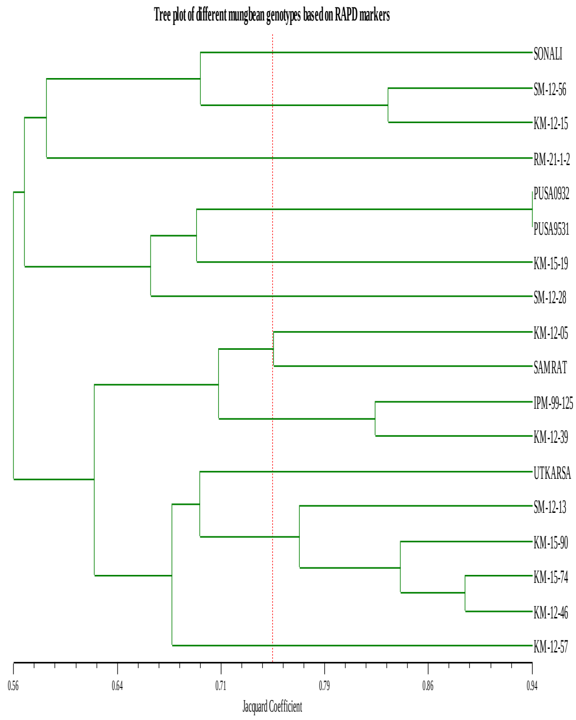

Fig-6 Tree plot of different mung bean genotypes based on RAPD markers

Conclusion

In the study, entry Utkarsha showed significantly superior grain yield over all the entries under studied & may be used in further breeding programmes.

Application of research: Selection of parents through cluster analysis & yield & yield attributing characters for further breeding programmes.

Research Category: Plant Breeding

Abbreviations:

GCV- Genotypic coefficient variation
PCV-Phenotypic coefficient variation
h2 - Heritability and
GA- Genetic advance
g- Gram
cm- Centimetre

Acknowledgement / Funding: Author thankful to AICRP, MULLaRP, Bidhan Chandra Krishi Viswavidyalaya Mohanpur, Nadia, West Bengal; Research and Development Unit, Maharashtra State Seed Corporation Ltd. for proving the seeds of germplasm for present research. Also thankful to ICAR-Sasya Shyamala Krishi Vigyan Kendra, Arapanch, Sonarpur, South 24 Pgs, Kolkata, 700103 & Integrated Rural Development and Management (IRDM) School of Agriculture and Rural Development, Ramakrishna Mission Vivekananda Educational and Research Institute, Ramakrishna Mission Ashrama, Narendrapur, Kolkata,700103

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Research project name or number: Research station trials

Author Contributions: All author equally contributed

Author statement: All authors read, reviewed, agree and approved the final manuscript

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.

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