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Genetic Variability Studies in Local Collections of Groundnut (Valencia Botanical Type)

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Abstract

Thirty-eight local collections of groundnut collected from different places of Gadchiroli district and evaluated along with two checks namely TAG-24 and Kopergaon-3 with three replication in RBD with the objective to estimate GCV, PCV, heritability and genetic advance for dry pod yield and yield components. Mean squares due to genotypes exhibited substantial genetic variability for dry pod yield plant^{-1} and yield components. Mean and range values revealed the significance of characters like hundred pod weight, plant height, shelling per cent, sound mature kernel per cent and dry pod yield plant^{-1} for selecting superior genotypes. Phenotypic coefficient of variation (PCV) were higher than their corresponding values of genotypic coefficient of variation (GCV) for all the characters indicating the influence of environment in the expression of genotypes along with the genetic potential. The highest GCV and PCV were recorded for number of mature pod plant^{-1}, number of immature pod plant^{-1} and dry pod yield plant^{-1} indicating high variation in these characters, predicting greater scope for improvement. High heritability along with high genetic advance were exhibited by number of mature pod plant^{-1}, number of immature pod plant^{-1}, dry pod yield plant^{-1}, hundred pod weight, shelling per cent, oil content and hundred kernel weight. Based on high GCV, PCV and high heritability along with genetic advance studied in this experiment, the characters i.e. number of mature pods plant^{-1}, number of immature pods plant^{-1} and dry pod yield plant^{-1} were identified for primary selection. Considering these characters seven local collections ACNGV-1, ACNGV-16, ACNGV-2, ACNGV-7, ACNGV-3, ACNGV-11 and ACNGV-6 were identified for further purification and multiplication for their use as promising genotypes (donors) in future breeding programme.

(Key word: Groundnut, variability, heritability, genetic advance and Valencia botanical type)

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) belongs to the family of *Leguminacae or Fabaceae* and sub-family *papiliaceae* or *faboideae*. The cultivated groundnut is tetraploid with chromosome number 2n = 40 and it is a self pollinated crop. It is one of the most important oilseed crop, commercially popular due to its superior quality of edible oil and protein. It contains up to the 40-45% oil, 26% protein and 46% and 32% of monounsaturated fatty acid (MUFA) and polyunsaturated fatty acid (PUFA) respectively. Groundnut oil is used in many preparation like soap making, fuels, cosmetics, shaving cream, lubricants etc. It is often used in cooking, because it has a mild flavour and a relatively high smoke point. The cakes and protein cake residue from oil processing is used as cattle feed due to high protein content and also as organic manure. Peanut flour is lower in fat than peanut butter, and is popular with chefs because its high protein content makes it suitable as a flavour enhancer.

Therefore, the assessment of genetic diversity is important objective for genetic improvement of groundnut to increase yield. For improving of yield in groundnut direct selection is often misleading. So the knowledge of existing variability between yield contributing characters and their relative contribution in yield is essential for developing high yielding genotypes in groundnut. But the existing variability is combined measure of genetic and environmental causes. The environmental variability is non heritable whereas, the genetic variability is heritable generation to generation. So, heritability and genetic advance is a useful tool for breeder in determining the direction and magnitude of selection.

MATERIALS AND METHOODS

An experiment comprising of 38 local collections of Valencia botanical type of groundnut were collected from farmers of Gadchiroli District of Maharashtra and two checks namely TAG-24 and Kopergaon-3, were evaluated in Randomized Block Design with three replications at experimental field of Agricultural Botany, College of Agriculture, Nagpur during year 2015. The unit size of plot was one row of 5 m length, row to row and plant to plant spacing were maintained at 30 cm and 10 cm respectively. Recommended dose of fertilizer, cultural practices and all plant protection measures were followed to ensure a good crop. Observations were recorded on the 14 characters on five randomly selected plants in each plot and in each replication. The data recorded were subjected to various statistical and biometrical analysis *viz.*, Analysis of variance (Panse and Sukhatme, 1954), estimation of genotypic and phenotypic coefficient of variation

(Burton and Devane, 1953), estimation of heritability in broad sense (Hanson *et al.*,1956) and estimation of genetic advance (GA) (Robinson *et al.*, 1949).

RESULT AND DISCUSSION

The analysis of variance for experimental design was worked out for 14 characters (table 1) revealed that the mean sum of squares due to genotypes were highly significant for all the characters studied. This reveals that the genotypes had sufficient amount of genetic variability among themselves for dry pod yield plant^{-1} and other yield components, which allow the further estimation of different parameters for all fourteen characters. Similar to this result, wide variability for dry pod yield plant^{-1} and yield contributing characters were also observed by John *et al.* (2013), Satish Yedlapalli (2014), Dewangan *et al.* (2015), Gupta *et al.* (2015) and Choudhary *et al.* (2016) in groundnut.

Mean and range for different characters

The mean, maximum, minimum and range values for 14 different traits measured in 38 local collections and two checks are presented in table 2. In this study plant height ranged from 43.10 cm to 84.33 cm, number of primary branches plant^{-1} from 2.87 to 3.87, number of secondary branches plant^{-1} from 3.33 to 5.34, number of mature pods plant^{-1} from 4.83 to 19.88, number of immature pods plant^{-1} from 5.00 to 15.94, days to 50 per cent flowering from 30.33 to 36.00, days to maturity from 107.33 to 114.33, dry haulm weight plant^{-1} from 19.60 g to 29.24 g, dry pod yield plant^{-1} from 5.77 g to 23.22 g, hundred pod weight from 75.67 g to 126.00 g, shelling per cent from 45.10 per cent to 65.07 per cent, sound mature kernel per cent from 43.00 per cent to 63.67 per cent, oil content ranged from 34.00 per cent to 47.33 per cent and hundred kernel weight from 26.76 g to 34.66 g.

The grand mean was found to be 74.96 cm for plant height, 3.21 for number of primary branches plant^{-1}, 4.45 for number of secondary branches plant^{-1}, 9.90 for number of mature pod plant^{-1}, 8.96 for number of immature pod plant^{-1}, 33.60 days for days to 50 per cent flowering, 110.30 days for days to maturity, 24.63 g for dry haulm weight plant^{-1}, 11.90 g for dry pod yield plant^{-1}, 102.22 g for hundred pod weight, 57.18 % for shelling per cent, 54.83 % for sound mature kernel per cent, 40.82 % for oil content and 29.76 g for hundred kernel weight.

The maximum range was recorded by hundred pod weight (50.33 g), followed by plant height (41.23 cm), sound mature kernel per cent (20.67 %), shelling per cent (19.97 %), dry pod yield plant^{-1} (17.45 g), number of mature pods plant^{-1} (15.05). This indicated the presence of considerable amount of genetic variance in groundnut local collections. These results revealed that characters like hundred pod weight, plant height, sound mature kernel per cent, shelling per cent and dry pod yield plant^{-1} showing maximum mean and range can be considered as traits for selecting superior genotypes. In accordance to these results John *et al.* (2013), Gupta *et al.* (2015), Balaraju and Kenchanagoudar (2016), Choudhary *et al.* (2016) also reported higher mean and range value for plant height, sound mature kernel per cent, shelling per cent, dry pod yield plant^{-1} in groundnut. Higher extent of variation reflecting in high range could be attributed to difference in the genetic composition of the groundnut local collections collected from different places. This might be due to genetic characteristic and/or acclimatization to the environment from where they were collected.

Estimates of genetic variability parameters

Results in table 2 indicated a considerable range of variation with respect to phenotypic and genotypic coefficient of variation. The study revealed that estimates of phenotypic coefficient of variation (PCV) were higher than their corresponding values of genotypic coefficient of variation (GCV) for all the fourteen characters under consideration indicating that, the apparent variation was not only due to genotypes but also due to the influence of environment in the expression of genotypes. The result were in accordance with the result of Zaman *et al.* (2011), Patil *et al.* (2015), Balaraju and Kenchanagoudar (2016) and Choudhary *et al.* (2016) in groundnut, who also observed higher value of PCV than their respective value of GCV due to the influence of environment.

The PCV and GCV were estimated from the corresponding variances and were used for the assessment of variability among the characters studied. The highest GCV and PCV were recorded for number of mature pods plant^{-1}, number of immature pods plant^{-1} and dry pod yield plant^{-1} indicating high variation in these characters and predicting greater scope for improvement of these three characters. Similarly, high variability has been recorded by Zaman *et al.* (2011), Vasanthi *et al.* (2011), Patil *et al.* (2015) for number of mature pods plant^{-1}, number of immature pods plant^{-1}and dry pod yield plant^{-1} in groundnut.

Estimates of heritability, genetic advance and response to selection as per cent of mean

The estimates of heritability in broad sense gives a measure of transmission of characters from one generation to another, thus giving an idea of heritable portion of variability and enabling the plant breeder in isolating the elite selection in the crop. Heritability and genetic advance increase the efficiency of the selection in a breeding programme by assessing the influence of environmental factors and additive gene action. The estimates of heritability in broad sense specifying the heritable portion of total variation and helps in identification of the appropriate characters for selection.

The heritability estimated for the 14 characters using 38 local collections and two checks of groundnut collected from different places are presented in table 2. High heritability were recorded for hundred pod weight (93 %), shelling per cent (90 %), number of immature pod plant^{-1}(83 %), dry pod yield plant^{-1}(83 %), hundred kernel weight (79.58 %), number of mature pod plant^{-1}(75 %) and oil content (63 %) reflecting the importance of these traits in selection programme. This indicated that these characters were less governed by a few major genes or additive gene effect even, if they were under polygenic control and therefore, selection of these characters would be more effective for yield improvement.

In accordance to these results Gupta *et al.* (2015) recorded high heritability for oil content (96.17 %), hundred pod weight (95.54 %), hundred kernel weight (91.63 %), shelling out-turn (62.74 %) and pod yield plant^{-1}(61.92 %) in groundnut. Patil *et al.* (2015) recorded high heritability for number of mature pods plant^{-1} (99 %), pod yield plant^{-1} (98 %), hundred kernel weight (98 %), number of immature pods plant^{-1} (97 %), oil content (96 %) and shelling per cent (91 %). Choudhary *et al.* (2016) recorded high heritability for seed oil content (98.47 %), hundred kernel weight (87.83 %), number of mature pods plant^{-1} (85.92 %), dry pod yield plant^{-1} (83.00 %), shelling out-turn (80.64 %) and sound mature kernel per cent (76.49 %).

Genetic advance as percentage of mean value were high for number of mature pods plant^{-1} (59.96 %), number of immature pods plant^{-1} (59.12 %), dry pod yield plant^{-1}(59.09 %), hundred kernel weight (56.93 %), hundred pod weight (24.05 %) and shelling per cent (20.37 %). Similar to these results high genetic advance as percentage of mean were also reported by Gupta *et al.* (2015) recorded high genetic advance as percentage of mean for hundred pod weight (37.01 %), hundred kernel weight (35.44 %) and pod yield plant^{1} (24.78 %). Patil *et al.* (2015) recorded high genetic advance as percentage of mean for number of immature pods plant^{-1} (98.73 %), number of mature pods plant^{-1} (61.76 %), pod yield plant^{-1}(49.14 %), per cent kernel weight (40.27 %), shelling per cent (21.23 %) and oil content (21.48 %). Choudhary *et al.* (2016) recorded high genetic advance as percentage of mean for number of mature pods plant^{-1} (24.87 %) and dry pod yield plant^{-1} (28.11 %).

Since, heritability estimates are influenced by environment, genetic material and also other factors hence their utility will be restricted. Thus, heritability in conjunction with genetic advance would give a more reliable index of selection value (Johnson *et al.,* 1955). Heritable variation can be determined with greater accuracy when heritability along with genetic advance is studied. High heritability with high genetic advance tells that, the character is governed by additive gene action and for that simple selection can be advocated.

In the present study, number of mature pod plant^{-1}, number of immature pod plant^{-1}, dry pod yield plant^{-1}, hundred pod weight, shelling per cent, oil content and hundred kernel weight showed the high heritability along with high genetic advance. Estimate of genetic advance help in understanding the type of gene action involved in the expression of various polygenic characters. High heritability along with high genetic gain indicated in these characters was due to considerable additive gene effects and selection may be effective. Thus, selection on the basis of these characters would be more effective for further breeding programs. Similar results to these were found by Zaman *et al.* (2011) for mature nut plant^{-1}, immature nut plant^{-1}, hundred nut weight, hundred kernel weight and yield plant^{-1} and Patil *et al.* (2015) for number of mature pod plant^{-1}, number of immature pod plant^{-1}, pod yield plant^{-1}, hundred kernel weight, shelling percent and oil content in groundnut.

Per se performance for different characters

The *per se* performance for 14 characters are presented in table 3. The local collections ACNGV-1, ACNGV-16 and ACNGV-2 were found to be significantly superior over best check (TAG-24) and mean for dry pod yield plant^{-1} and local collections ACNGV-7, ACNGV-3, ACNGV-11, and ACNGV-6 were found to be significantly superior over mean for dry pod yield plant^{-1}. Among these ACNGV-1 ranked first and significantly superior over mean for dry pod yield plant^{-1} (23.22 g) and significantly superior over mean for shelling per cent (63.33 %), number of mature pods plant^{-1}

(16.16), hundred kernel weight (34.33 g), number of primary branches plant^{-1} (3.80) and at par for sound mature kernel per cent (60.33 %), days to 50 per cent flowering (34.66), number of immature pods plant^{-1} (9.27) and number of secondary branches plant^{-1} (5.33). ACNGV-16 ranked second for dry pod yield plant^{-1} and significantly superior over mean for dry pod yield plant^{-1} (17.39) number of mature pod plant^{-1} (19.88), number of immature pod plant^{-1} (11.27) and at *par* for days to maturity (110.66), hundred pod weight (104.66), plant height (79.10), sound mature kernel per cent (63.67) and days to 50 per cent flowering (33.66). ACNGV-2 ranked third for dry pod yield plant^{-1} (16.86) and significantly superior over mean for dry pod yield plant^{-1} (16.86), hundred pod weight (115.66) and at *par* for sound mature kernel per cent (61.33), shelling per cent (59.48), oil content (42.00), days to 50 per cent flowering (33.66), number of mature pods plant^{-1} (12.00), number of immature pods plant^{-1} (10.11) and secondary branches plant^{-1} (4.66) followed by ACNGV-7 was found significantly superior over mean for dry pod yield plant^{-1} (14.85) and at *par* for days to maturity (111.00), days to 50 per cent flowering (34.00), dry haulm weight plant^{-1} (26.14), hundred kernel weight (30.33) and number of mature pods plant^{-1} (10.34).

ACNGV-3 found to be significantly superior over mean for dry pod yield plant^{-1} (14.58), days to maturity (112.66), oil content (45.66), number of primary branches plant^{-1} (3.87), and at *par* for days to 50 per cent flowering (34.66), dry haulm weight plant^{-1} (26.80), plant height (78.60) and number of mature pods plant^{-1} (11.56). ACNGV-11 was found to be significantly superior over mean for dry pod yield plant^{-1} (14.45) and at *par* for days to maturity (110.66), dry haulm weight plant^{-1} (29.24), days to 50 per cent flowering (34.33), number of immature pods plant^{-1} (12.22), number of mature pods plant^{-1} (10.61) and number of secondary branches plant^{-1} (4.66). ACNGV-6 to be significantly superior over mean for dry pod yield plant^{-1} (14.19) and at *par* for days to maturity (110.33), 100 pod weight (102.00), sound mature kernel per cent (63.00), number of secondary branches plant^{-1} (4.66), number of mature pods plant^{-1} (12.94) and number of immature pods plant^{-1} (11.08).

From the various aspects of genetic parameters (GCV, PCV, heritability and genetic advance expressed as percentage of mean) studied in this experiment, the characters i.e., number of mature pods plant^{-1}, number of immature pods plant^{-1} and dry pod yield plant^{-1} were identified for primary selection as they had high GCV, PCV and high heritability along with genetic advance.

Considering this character, the local collections ACNGV-1, ACNGV-16, ACNGV-2, ACNGV-7, ACNGV-3, ACNGV-11 and ACNGV-6 which showed significant superior mean were identified for further purification and multiplication and as promising breeding parents (donors) in imperial groundnut breeding programme.

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Table 1. Analysis of variance for various traits in groundnut

Sources of Variation	D.F	Mean sum of squares													
		Plant height	Number of primary branches plant-1	Number of secondary branches plant-1	Number of mature pod plant-1	Number of immature pod plant-1	Days to 50% flowering	Days to maturity	Dry haulm weight plant-1	Hundred pod weight	Shelling percent	Sound mature kernel percent	Oil content	Hundred kernel weight	Dry pod yield plant-1
Replications	2	2.28	0.11	0.52	5.87	2.49	3.77	4.07	3.11	1.81	0.35	99.16	4.80	7.71	4.56
Genotypes	39	209.09**	0.20**	0.67**	22.25**	15.44**	2.41**	4.80**	13.79**	285.19**	67.44**	69.40**	27.11**	8.46**	27.33**
Error	78	54.82	0.10	0.36	2.17	0.96	1.24	1.41	7.33	6.62	2.44	36.87	4.47	4.47	1.73

* Significant at 5 % level ** Significant at 1 % level

Table 2. Mean, range, GCV, PCV, Heritability and Genetic advance for different traits in the local collections of groundnut

Sr.No	Characters	Mean	Min.	Max.	Range	GCV (%)	PCV (%)	Heritability (%)	G.A.	GA (%of mea)
1	Plant height (cm)	74.96	43.10	84.33	41.23	9.57	13.75	48	13.17	17.57
2	Number of primary branches plant^{-1}	3.21	2.87	3.87	1.00	5.82	11.67	25	0.25	7.68
3	Number of secondary branches plant^{-1}	4.45	3.33	5.34	2.01	7.26	15.36	22	0.40	9.07
4	Number of mature pod plant^{-1}	9.90	4.83	19.88	15.05	26.14	30.09	75	5.93	59.96
5	Number of immature pod plant^{-1}	8.96	5.00	15.94	10.94	24.53	26.86	83	5.30	59.12
6	Days to 50 per cent flowering	33.60	30.33	36.00	5.67	1.86	3.81	24	0.80	2.39
7	Days to maturity	110.30	107.33	114.33	7.00	0.96	1.44	45	1.87	1.70
8	Dry haulm weight plant^{-1} (g)	24.63	19.60	29.24	9.64	5.96	12.50	23	1.84	7.49
9	Hundred pod weight (g)	102.22	75.67	126.00	50.33	9.43	9.76	93	24.58	24.05
10	Shelling per cent (%)	57.18	45.10	65.07	19.97	8.14	8.59	90	11.65	20.37
11	Sound mature kernel per cent (%)	54.83	43.00	63.67	20.67	6.01	12.60	23	4.14	7.56
12	Oil content (%)	40.82	34.00	47.33	13.33	6.73	8.49	63	5.75	14.08
13	Hundred kernel weight (g)	29.76	26.33	34.66	8.33	3.88	8.09	80	47.60	56.93
14	Dry pod yield plant^{-1} (g)	11.90	5.77	23.22	17.45	24.54	26.91	83	7.03	59.09

Table 3. Mean performance of local collections of groundnut for dry pod yield plant^{-1} and yield contributing traits

Genotypes	Plant height (cm)	Number of primary branches plant^{-1}	Number of secondary branches plant^{-1}	Number of mature pods plant^{-1}	Number of immature pods plant^{-1}	Days to 50 per cent flowering	Days to maturity	Dry haulm weight plant^{-1} (g)	Hundred pod weight (g)	Shelling per cent (%)	Sound mature kernel per cent	Oil content (%)	Hundred kernel weight (g)	Dry pod yield plant^{-1} (g)
ACNGV-1	58.00	3.80	5.33	16.16	9.27	34.66	111.00	22.85	98.33	63.53	60.33	39.00	34.33	23.22
ACNGV-2	78.03	3.20	4.66	12.00	10.11	33.66	110.33	21.53	115.67	59.48	61.33	42.00	28.67	16.86
ACNGV-3	78.60	3.87	4.33	11.56	7.27	34.66	112.67	26.80	101.67	55.73	53.67	45.67	27.33	14.59
ACNGV-4	81.33	3.00	4.66	9.44	6.47	34.00	111.33	25.11	95.33	52.49	55.00	45.67	30.67	11.67
ACNGV-5	73.20	2.86	4.33	8.20	8.33	33.33	109.67	23.59	100.33	53.90	50.00	45.67	28.33	8.26
ACNGV-6	74.46	2.86	4.66	12.94	11.08	33.33	110.33	22.38	102.00	56.63	63.00	36.00	29.33	14.19
ACNGV-7	72.40	3.20	4.33	10.34	8.55	34.00	111.00	26.14	98.67	56.75	43.00	38.00	30.33	14.85
ACNGV-8	80.13	3.06	4.00	8.66	9.41	33.66	111.00	27.29	111.00	53.41	46.00	39.00	31.33	11.64
ACNGV-9	77.40	3.13	5.00	9.83	15.94	33.66	109.67	21.07	123.67	52.45	54.33	39.67	31.33	13.30
ACNGV-10	73.65	3.40	5.33	10.83	10.33	33.66	110.33	24.84	104.33	62.18	52.33	43.33	30.00	13.75
ACNGV-11	74.40	2.93	4.66	10.61	12.22	34.33	110.67	29.24	95.67	56.60	51.33	39.33	27.33	14.45
ACNGV-12	75.33	3.33	4.33	11.33	10.25	33.66	109.33	27.73	126.00	59.29	56.67	43.33	29.33	12.15

ACNGV-13	79.80	3.33	4.33	10.16	6.36	33.66	109.33	24.35	119.00	48.25	58.67	44.33	29.33	12.19
ACNGV-14	79.13	3.33	4.00	12.66	7.36	33.33	109.00	26.35	104.67	52.50	58.00	41.67	29.67	9.49
ACNGV-15	82.20	3.06	4.33	9.44	7.16	33.66	112.33	26.88	108.00	51.37	55.33	47.33	29.33	11.85
ACNGV-16	79.10	3.07	4.00	19.88	11.27	33.66	110.67	22.62	104.67	65.07	63.67	39.67	30.00	17.39
ACNGV-17	80.20	3.00	5.00	8.83	6.33	33.00	109.67	22.49	94.33	60.97	55.33	39.00	29.33	12.35
ACNGV-18	81.80	3.00	4.00	7.61	11.05	33.33	110.67	25.80	98.00	62.65	61.67	38.33	29.00	11.96
ACNGV-19	75.33	3.26	3.66	8.61	7.27	33.66	110.00	27.70	108.67	52.27	55.33	40.33	30.67	10.45
ACNGV-20	73.13	3.00	4.33	8.33	10.11	34.00	110.33	22.00	95.33	62.61	52.00	38.67	29.67	8.71
ACNGV-21	76.53	3.06	5.00	8.44	12.50	34.33	109.33	24.51	94.00	61.39	59.33	40.67	28.67	10.82
ACNGV-22	74.26	3.06	4.33	9.66	7.75	33.66	108.67	26.73	108.67	57.77	53.00	42.33	26.33	9.51
ACNGV-23	79.20	3.40	4.66	9.27	7.50	33.00	109.00	26.90	100.00	53.97	59.67	40.33	32.67	12.06
ACNGV-24	80.20	3.00	3.66	9.16	9.27	33.66	109.67	24.48	102.00	62.00	53.67	41.33	29.33	11.40
ACNGV-25	82.13	3.00	4.00	9.77	7.33	35.00	110.33	25.90	99.00	58.49	57.67	43.67	27.67	12.89
ACNGV-26	84.33	2.93	4.33	8.61	5.00	33.00	109.33	26.17	109.33	63.94	56.00	41.00	30.00	10.66
ACGGV-27	80.60	2.86	5.00	8.44	6.33	30.33	107.33	26.52	99.00	50.42	58.33	44.00	30.00	11.91
ACGGV-28	80.13	3.66	4.00	7.33	8.27	32.00	108.67	24.29	109.67	53.28	54.67	44.67	28.67	9.82
ACGGV-29	78.73	2.93	4.66	8.44	6.58	33.00	109.33	21.85	98.33	59.97	54.67	41.00	31.67	8.67
ACGGV-30	82.06	3.26	4.00	13.83	7.25	31.66	109.67	22.60	101.67	56.17	56.00	38.67	30.33	11.

ACGGV-31	78.00	3.00	5.00	6.33	8.77	34.00	111.33	23.20	96.00	63.56	43.33	37.33	30.67	287.25
ACGGV-32	79.06	3.66	4.66	8.27	7.00	33.66	109.67	26.47	114.67	45.10	55.33	41.00	30.67	5.77
ACGGV-33	73.80	3.33	5.00	7.83	7.92	33.66	111.00	26.42	99.00	58.31	53.67	40.67	29.00	10.26
ACGGV-34	74.46	3.06	4.33	10.77	14.00	33.33	110.67	23.98	96.33	58.14	54.00	34.00	29.00	12.20
ACGGV-35	52.86	3.46	4.33	8.33	11.22	33.33	111.33	23.62	82.33	62.88	50.33	39.00	34.67	12.77
ACGGV-36	65.60	3.26	4.33	12.61	9.11	34.33	111.33	23.33	88.00	58.98	58.33	42.00	28.67	12.40
ACGGV-37	67.93	3.33	4.66	6.94	9.25	34.00	109.67	23.45	104.00	60.07	53.67	40.00	29.67	9.25
ACGGV-38	75.33	3.13	3.33	7.33	10.36	33.33	109.67	24.31	103.00	55.72	58.00	35.00	29.67	11.40
TAG-24	43.10	3.70	4.00	12.11	8.38	33.66	112.33	19.60	75.67	51.69	46.67	37.33	27.33	13.67
Kopergaon-3	62.50	3.40	5.33	4.83	8.27	36.00	114.33	24.15	102.67	57.25	50.00	43.00	30.33	8.83
Grand Mean	**74.96**	**3.20**	**4.45**	**9.89**	**8.95**	**33.60**	**110.30**	**24.63**	**102.22**	**57.18**	**54.83**	**40.82**	**29.76**	**11.90**
S.E.	4.27	0.18	0.34	0.85	0.56	0.64	0.69	1.56	1.49	0.90	3.51	1.22	1.22	0.76
C.D. 5%	12.03	0.52	0.97	2.39	1.59	1.81	1.93	4.40	4.18	2.54	9.87	3.44	3.44	2.14

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