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To determine the physical characteristics of some promising varieties/genotypes of chickpea

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Abstract
Twenty varieties/genotype viz. Vijay, BG-256, JG-16, CSG-8961, BG-372, K-3256, KWR-108, KPG-59, Radhey, Avarodhi KGD-1288, KGD-1295, KGD-1296, KGD-1302, KGD-1315, KGD-1316, KGD-2012, Pusa-209, Pusa-391 and RBG-1 were taken from oil seed research farm Chandra Shekhar Azad University of Agriculture and Technology, The quality parameter like Grain yield, 1000 seed weight, Dhal recovery, Husk recovery, Broken dhal, Loss on processing were studies under after harvest of crop. Grain sample from different varieties/genotypes were brought to laboratory. The range of variability in chickpea varieties/genotypes was from Grain yield (11.39-19.35 q/ha), 1000 seed weight (153.05-292.85g), Dhal recovery (76.59-84.22%), Husk recovery (10.32-14.30%), Broken dhal (1.70-4.22%), Loss on processing (3.32-5.59%). Among the Chickpea genotype KGD-1316 appeared to be the best having excelled in two physical characters such as grain yield and test weight out of the six physical parameter was studied.

Keywords: Grain yield, test weight, dhal recovery, husk recovery, broken dhal and loss on processing

Introduction
Chickpea commonly known as gram or Bengal gram (*Cicer arietinum* L.), a member of family Leguminaceae and subfamily Papilinoceae, is an important self-pollinated leguminous crop, diploid annual (2n = 16 chromosomes). It is the most important crop of India grown during rabi season. Among the pulses, chickpea is grown since 7000 BC in different areas of the world but its cultivation is mainly concentrated in semi-arid environments. It is grown mainly in India, Pakistan, Iran, Burma, Turkey, Spain, Portugal, Morocco, Ethiopia, Tanzania, Chile, Mexico, and USA. India ranks first in the world in respect of production as well as acreage of chickpea crop followed by Pakistan (Uttamrao *et al*., 2018) [6]
In India, the major chickpea producing states are Madhya Pradesh, Rajasthan, Uttar Pradesh, Maharastra, Karnataka and Andhra Pradesh which contribute more than 90 percent towards total average and about 88% of the national production. In India all pulses are grown in an area of 29.44 m/ha with production of 23.13 million tones and productivity of 786 kg/ha. Chickpea India occupies 10.76 million ha area with a production of 11.16 million tonnes and productivity of Uttar pradesh has been possesses area of 562 thousand hectares, production of 626 thousand tonnes and productivity 1114 kg/ha (Anonrmous, 2018) [1]. The kabuli type seeds have a light seed coat ranging in colour from white to cream and 100-seed weight is 28-70 g. Desi type chickpea seeds have a thicker skin, irregular shaped seed coat ranging in colour from light to black, with 100-seed weight up to 28g (Segev *et al.*, 2010) [2]
Gram is used for the human consumption as well as for feeding animals. It is eaten both whole fried or boiled and salted or more generally in the form of the split pulse (dhal), which is cooked and eaten. Both husks and bits of "dhal" form valuable cattle feed. Green foliage and green grains are also used as vegetables. Straw of gram is an excellent fodder for cattle.

Materials and Methods
1. Grain yield: After threshing and winnowing of produce the grain yield of each plot was recorded. Finally, it was computed in term of q/ha for each genotypes/varieties.
2. 1000 seed weight: To observe the extent of grain filling, 100 seeds of each replication were weighted out. The results were, however, reported as 1000 grains weight by multiplying ten times.
3. Dhal recovery, husk recovery, broken dhal percentage, loss on processing: Dhal was prepared by soaking 50 g of grains in 100 ml of water for one hour.

Water was drained off. Moist grains were kept at room temperature for 24 hours and then dried in electro oven for 4 hours at 70^0C. A light roller / hand chakki was applied for splitting the grains into dhal and husk. The husk was separated mechanically and weighed. The broken dhal was passed through one mm sieve to separate it from whole dhal. The whole dhal fraction and broken dhal fractions were weight separately and their percentage calculated. Combined weights of dhal and husk were deducted from weight of seed to obtain the percentage loss in processing.

Results and Discussion

1. Grain yield of various varieties/genotypes of chickpea

The data on grain yield were subjected to pooled analysis and the results are presented according to different varieties/genotypes of chickpea are given in Table-1 and depicted in Graph-1 The results clearly indicate that significant differences were observed within varieties/genotypes which ranged from 11.39-19.35 q/ha with a mean of 17.24 q/ha in chickpea. Genotypes KGD-1316 showed maximum pooled grain yield of (19.35 q/ha) followed by KGD-1295 (19.06q/ha) and KGD-1315 (19.02q/ha). The minimum pooled grain yield (11.39 q/ha) of chickpea was obtained in BG-372. Similar results were also found by Thangwana and Ogola (2012) [3]. Grain yield was greater at the high (2149 kg ha-1) compared with the low (1035 kg ha-1) planting density in the summer sowing. Grain yield was greater in the winter (3308.3 kg ha-1) compared with the summer (1483.7 kg ha-1) sowing.

2. 1000-grain weight (g) in various varieties/genotypes of chickpea grain

The data obtained on 1000 grain weight during both years in respect of different varieties/genotypes of chickpea are given in Table-1 and depicted in Graph-2 which clearly indicates that significant differences were observed within varieties/genotypes ranged from 153.5 to 292.85g, with a mean of 235.96g in chickpea. Highest pooled 1000 grain weight 292.85g of chickpea was obtain in KGD-1316 followed by Pusa-391 (289.40g) and KGD-1315 (289.35g) while lowest 1000 grain weight 135.05g was recorded in chickpea variety BG-372. Similar results were also found by Uttamrao *et al.* (2018) [6] reported that 1000 seed weight of 10 varieties/genotypes of gram varied from 118.70 to 220.80g. Tripathi *et al.* (2018) [5] which was reported the test weight ranged from 136.10 to 247.00 g.

3. Dhal recovery of important varieties/genotypes of chickpea

A presented of data obtained on dhal recovery percentage during both years and pooled in respect of different varieties/genotypes of chickpea are showed in Table-2 depicted in Graph-3 which clearly indicates that the significant differences were observed in within varieties/genotypes and ranged from 76.59 to 84.22 per cent with a mean value of 80.72 per cent. Genotype KGD-1315 showed the highest dhal recovery of 84.22 per cent followed by KGD-1295 and Pusa-209 gave dhal recovery of 83.90 and 83.28 per cent, respectively. Genotype CSG-8961 showed that the lowest dhal recovery of 76.59 per cent of chickpea. Similar results are also reported such as Uttamrao *et al.* 2018 [6] the recovery of whole grain in different varieties of chickpea ranged from 68-87%. Tikle *et al.* 2018 [4] reported that the range varied from 70.69 to 71.04%.

4. Husk recovery of important varieties/genotypes of chickpea

The data pertaining to husk recovery showing mean values of two years as well as pooled data in respect of different varieties/genotypes of chickpea are presented in Table-2 and depicted in Fig. 4 It is observed that the varieties and genotypes varied significantly in respect of husk recovery in both years as well as pooled. Husk recovery in different genotypes/varieties of gram ranged from 10.32 to 14.30 percent with a mean value of 12.33 per cent. Genotype BG-256 showed maximum husk recovery of 14.30 percent, followed by CSG-8961 and KGD-1288 husk recovery of 14.25 and 14.08 per cent, respectively. Genotypes KGD-1315 showed minimum husk recovery of 10.32 per cent of chickpea. Similar results are found such as Uttamrao *et al.* 2018 [6] different varieties of chickpea showed variation in husk per cent from 11.42-16.42%. Tikle *et al.* 2018 [4] reported that the range varied from 8.47 to 9.47%.

5. Broken dhal of important varieties/genotypes of chickpea

The data obtained on broken dhal percentage during both years as well as pooled in respect of different varieties/genotypes of chickpea are given in Table-3 and depicted in Fig-5. It clearly indicates that the significant differences were observed in within varieties/genotypes of chickpea which ranged from 1.70 to 4.22 % with a mean value 2.80 per cent. The highest broken dhal 4.22 per cent was obtained in chickpea genotype BG-372 followed by CSG-8961 and KWR-108 broken dhal of 4.19 and 4.13 per cent, respectively. Chickpea variety Pusa-209 showed the lowest broken dhal percentage of 1.70 per cent Similar results are found such as Uttamrao *et al.* 2018 [6] different varieties of chickpea showed variation broken dhal 0.45 to 5.28%.

6. Loss on processing of important varieties/genotypes of chickpea

A perusal of data on loss on processing showing pooled values of two years data in respect of different varieties/genotypes of chickpea are presented in Table-3 and depicted in Fig-6. It is observed that the varieties and genotypes were significantly influenced in respect of both the years as well as pooled data. Loss on processing in different genotypes/varieties of chickpea ranged from 3.32 to 5.33 percent with a mean value of 4.15 per cent. Genotype KGD-1302 showed maximum loss on processing of 5.59 per cent followed by KGD-1316 and BG-372 loss on processing of 5.33 and 5.14 per cent, respectively. Chickpea varieties Vijay showed minimum loss on processing of 3.32 per cent. Similar results are reported by Uttamrao *et al.* 2018 [6] loss on processing in different varieties of chickpea showed variation 1.76 to 13.82%.

Table 1: Grain yield and Test weight of important varieties/genotypes of chickpea (*Cicer arietinum* L.)

Varieties/Genotypes	Grain yield (q/ha)			Test weight (g)/1000 Seed weight		
	Mean		Pooled Mean	Mean		Pooled Mean
	2018-2019	2019-2020		2018-2019	2019-2020	
Vijay	18.39	17.95	18.17	257.1	254.3	255.70
BG-256	17.25	16.83	17.04	232.2	230.7	231.45
JG-16	16.34	16.30	16.32	201.5	200.3	200.90
CSG-8961	11.38	11.95	11.66	160.4	162.6	161.50
BG-372	11.10	11.68	11.39	152.5	153.6	153.05
K-3256	17.39	18.10	17.74	248.2	250.7	249.45
KWR-108	16.25	16.45	16.35	186.6	187.5	187.05
KPG-59	18.10	17.35	17.72	201.3	198.8	200.05
Radhey	17.90	16.85	17.37	249.4	248.7	249.05
Avarodhi	17.30	16.85	17.07	200.5	197.8	199.15
KGD-1288	16.45	18.10	17.27	198.5	201.1	199.80
KGD-1295	19.37	18.75	19.06	290.1	287.6	288.85
KGD-1296	18.60	18.10	18.35	245.5	243.4	244.45
KGD-1302	18.90	19.10	19.00	256.7	259.4	258.05
KGD-1315	19.30	18.75	19.02	290.2	288.5	289.35
KGD-1316	19.80	18.90	19.35	293.4	292.3	292.85
KGD-2012	17.65	18.05	17.85	248.5	250.2	249.35
Pusa-209	18.20	17.90	18.05	259.7	257.4	258.55
Pusa-391	18.35	18.60	18.47	288.6	290.2	289.40
RBG-1	17.25	17.83	17.54	260.8	261.5	261.15
Mean	17.26	17.22	17.24	236.09	235.83	235.96
S.E. (m) ±	0.25	0.24	0.24	3.18	3.60	3.41
C.D. (5%)	0.73	0.69	0.70	9.12	10.33	9.80

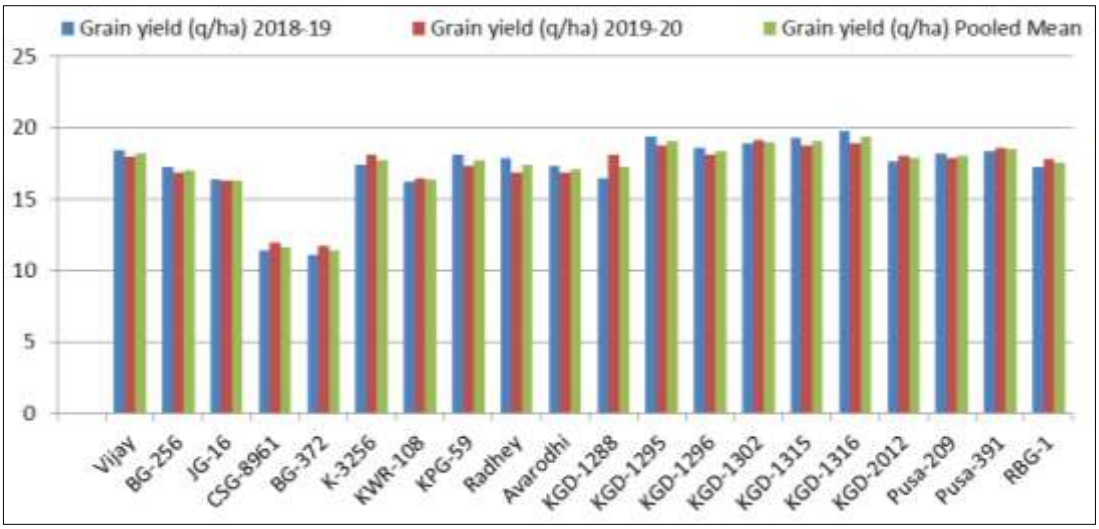

Fig 1: Grain yield of important varieties/genotypes of chickpea (*Cicer arietinum* L.)

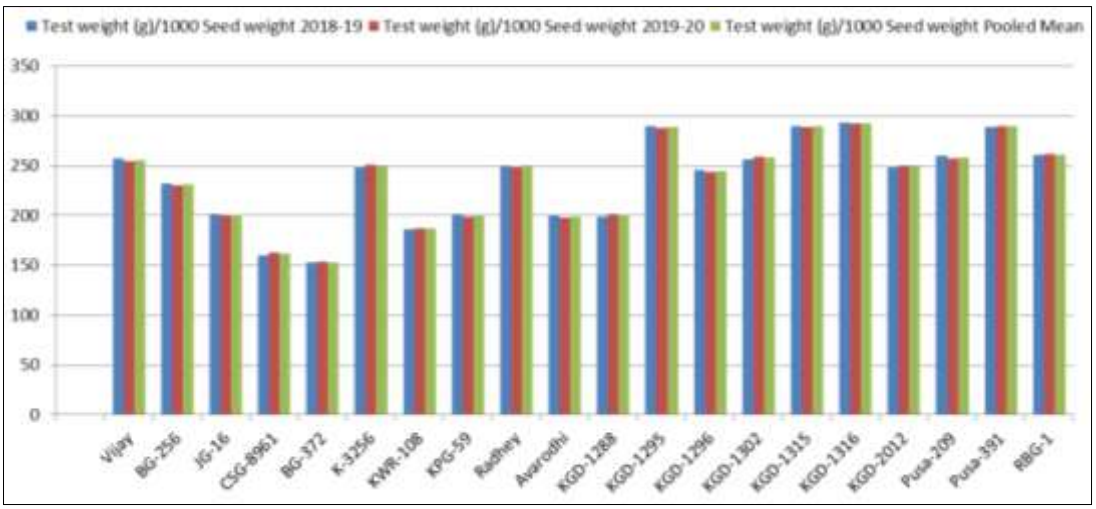

Fig 2: Test weight of important varieties/genotypes of chickpea (*Cicer arietinum* L.)

Table 2: Dal recovery and Husk recovery of important varieties/ genotypes of chickpea (*Cicer arietinum* L.)

Varieties/Genotypes	Dal recovery (%)			Husk recovery (%)		
	Mean		Pooled Mean	Mean		Pooled Mean
	2018-2019	2019-2020		2018-2019	2019-2020	
Vijay	82.56	82.42	82.49	10.48	10.57	10.525
BG-256	79.82	79.76	79.79	11.85	11.76	11.805
JG-16	79.38	79.32	79.35	12.02	11.94	11.98
CSG-8961	77.67	77.52	77.595	13.18	13.32	13.25
BG-372	77.18	77.47	77.325	13.34	13.28	13.31
K-3256	81.95	82.05	82.00	10.78	10.68	10.73
KWR-108	77.93	78.15	78.04	12.97	13.08	13.025
KPG-59	78.22	78.12	78.17	12.82	12.89	12.855
Radhey	81.83	81.79	81.81	10.88	10.94	10.91
Avarodhi	78.98	78.86	78.92	12.35	12.44	12.395
KGD-1288	78.63	78.84	78.735	12.65	12.52	12.585
KGD-1295	82.95	82.85	82.90	10.07	10.15	10.11
KGD-1296	80.92	80.78	80.85	11.35	11.42	11.385
KGD-1302	81.05	81.38	81.215	11.02	10.91	10.965
KGD-1315	83.82	83.63	83.725	9.76	9.89	9.825
KGD-1316	82.85	82.62	82.735	10.15	10.32	10.235
KGD-2012	80.64	80.87	80.755	11.45	11.39	11.42
Pusa-209	82.35	82.22	82.285	10.63	10.51	10.57
Pusa-391	82.82	82.89	82.855	10.36	10.28	10.32
RBG-1	82.73	82.89	82.81	10.40	10.58	10.49
Mean	80.86	80.57	80.72	12.38	12.29	12.33
S.E. (m) ±	1.12	1.11	1.37	0.15	0.17	0.17
C.D. (5%)	3.21	3.19	3.94	0.44	0.50	0.49

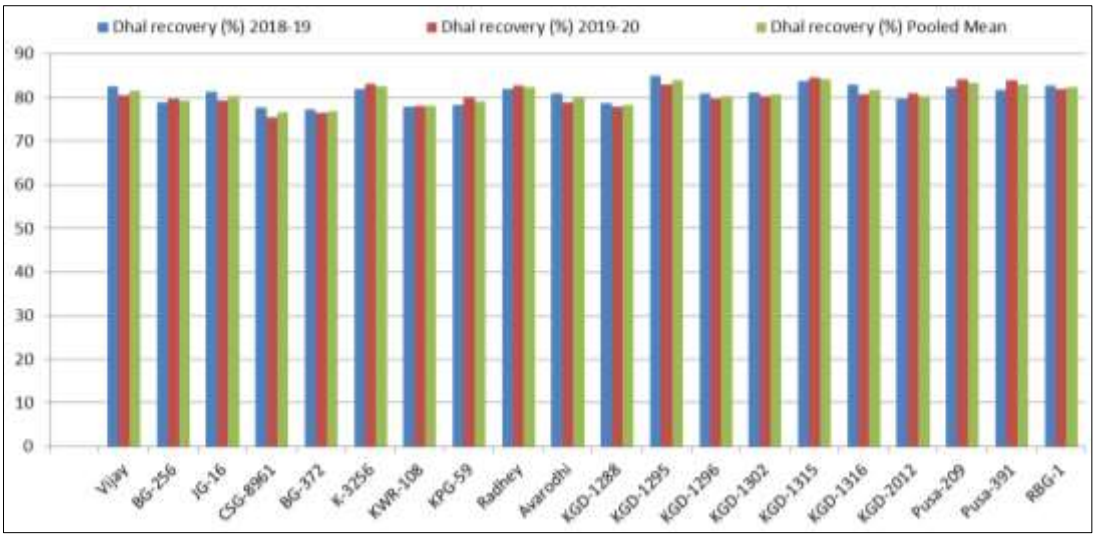

Fig 3: Dhal recovery of important varieties/genotypes of chickpea (*Cicer arietinum* L.)

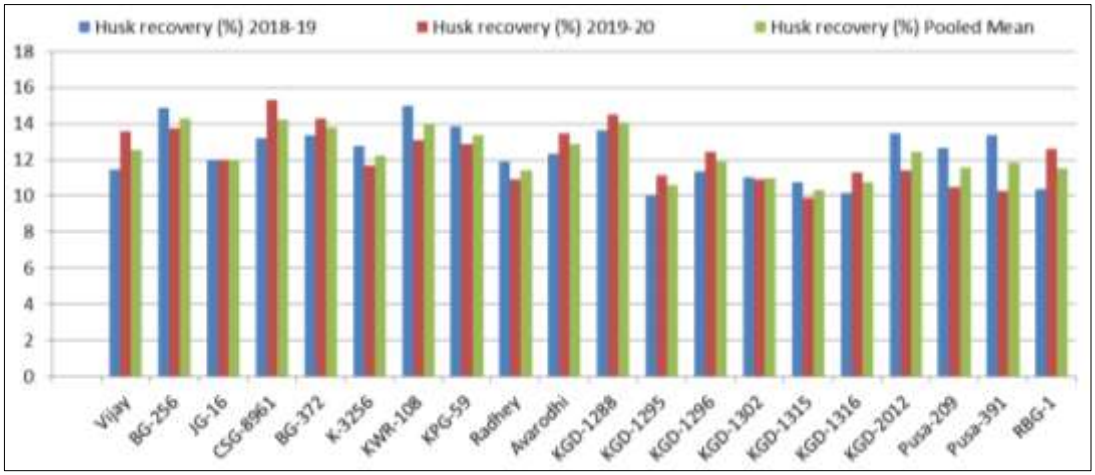

Fig 4: Husk recovery of important varieties/genotypes of chickpea (*Cicer arietinum* L.

Table 3: Broken dal percentage and Loss on processing of some varieties/genotypes of chickpea (*Cicer arietinum* L.)

Varieties/Genotypes	Broken dal percentage (%)			Loss on processing (%)		
	Mean		Pooled Mean	Mean		Pooled Mean
	2018-2019	2019-2020		2018-2019	2019-2020	
Vijay	3.15	3.18	3.165	3.81	3.83	3.82
BG-256	3.45	3.51	3.48	4.88	4.97	4.925
JG-16	3.48	3.53	3.505	5.12	5.21	5.165
CSG-8961	3.68	3.71	3.695	5.47	5.45	5.46
BG-372	3.70	3.74	3.72	5.78	5.51	5.645
K-3256	3.35	3.38	3.365	3.92	3.89	3.905
KWR-108	3.62	3.65	3.635	5.48	5.12	5.30
KPG-59	3.54	3.60	3.57	5.42	5.39	5.405
Radhey	3.36	3.39	3.375	3.93	3.88	3.905
Avarodhi	3.49	3.54	3.515	5.18	5.16	5.17
KGD-1288	3.52	3.57	3.545	5.2	5.07	5.135
KGD-1295	2.88	2.92	2.90	4.1	4.08	4.09
KGD-1296	3.48	3.51	3.495	4.25	4.29	4.27
KGD-1302	3.42	3.43	3.425	4.51	4.28	4.395
KGD-1315	2.65	2.69	2.67	3.77	3.79	3.78
KGD-1316	2.92	2.98	2.95	4.08	4.08	4.08
KGD-2012	3.38	3.45	3.415	4.53	4.29	4.41
Pusa-209	3.19	3.22	3.205	3.83	4.05	3.94
Pusa-391	3.02	3.05	3.035	3.8	3.78	3.79
RBG-1	3.15	3.05	3.10	3.72	3.48	3.6
Mean	2.72	2.88	2.80	4.04	4.26	4.15
S.E. (m) ±	0.05	0.04	0.04	0.06	0.07	0.07
C.D. (5%)	0.15	0.12	0.11	0.18	0.20	0.21

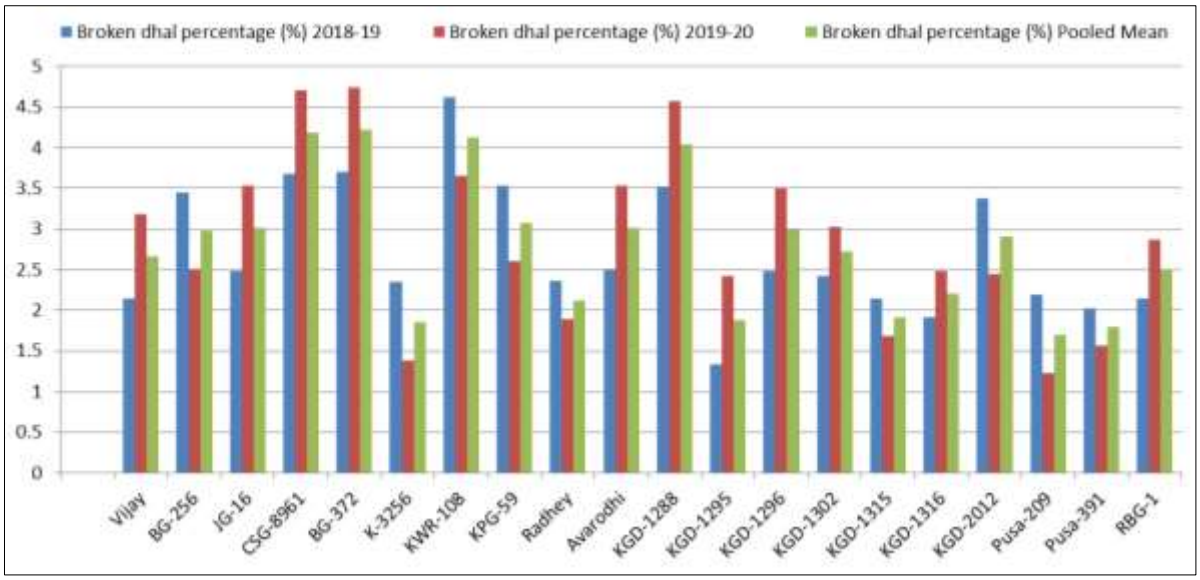

Fig 5: Broken dhal percentage of important varieties/genotypes of chickpea (*Cicer arietinum* L.)

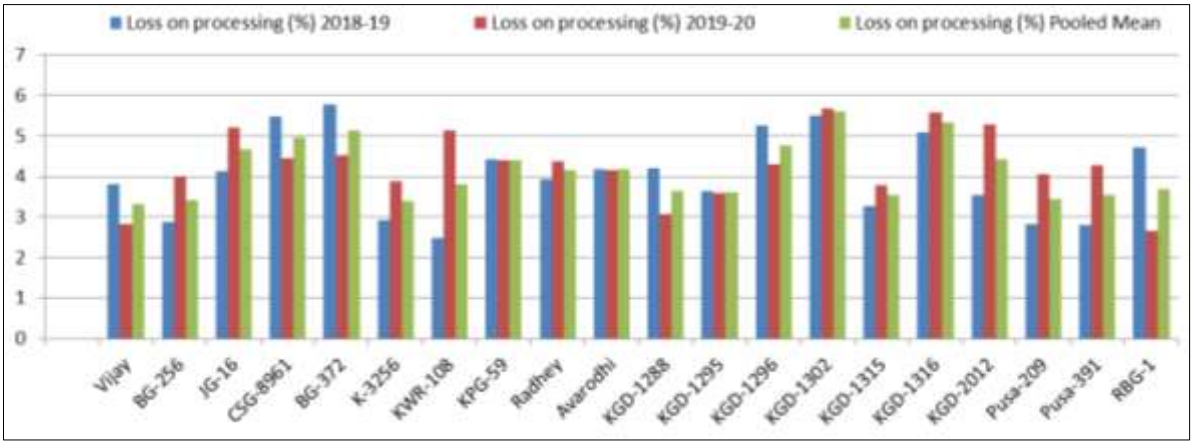

Fig 6: Loss on processing of important varieties/genotypes of chickpea (*Cicer arietinum* L.

Conclusion

Based on the results emerging out of the present investigation it may inferred that of chickpea varieties/genotypes proved beneficial increasing most of the desirable quality characteristics. Genotype KGD-1316 was superior in grain yield and 1000 seed weight out of six parameter studied and which appeared to be first in merit was identified us a genotype having yield quality balance.

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