

**SEED WEIGHT OF SUNFLOWER GERmplASMS: REVISITED**

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This brief communication is in continuation of a paper published earlier (Khan *et al.*, 2011) in connection with the seed mass variation in seed lots of nine cultivars (S-278, Hysun 33, Hysun 39, N.K. Armani, Aussie gold 04, Aussie gold 61, Aussie gold 62, local and Hybrid 1) of sunflower (*Helianthus annuus* L.). In this report three new germplasms of sunflower (Hysun 666, Golden 1 and Agsun 8251) are included.

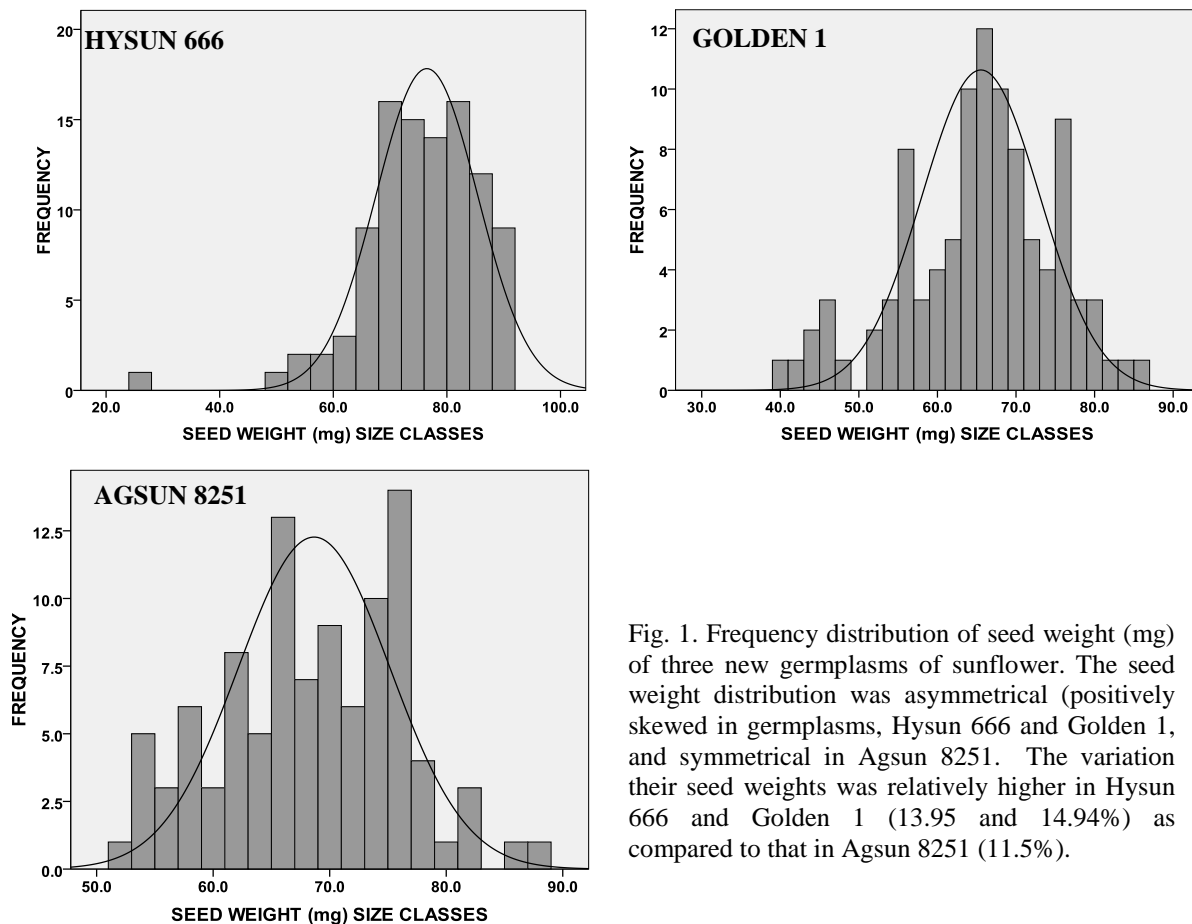


Fig. 1. Frequency distribution of seed weight (mg) of three new germplasms of sunflower. The seed weight distribution was asymmetrical (positively skewed in germplasms, Hysun 666 and Golden 1, and symmetrical in Agsun 8251). The variation their seed weights was relatively higher in Hysun 666 and Golden 1 (13.95 and 14.94%) as compared to that in Agsun 8251 (11.5%).

The methodology employed to estimate seed weight characteristics was essentially the same as described in Khan *et al.* (2011). Location and dispersion parameters of twelve cultivars are presented in Table 1. The frequency distribution of newly studied germplasms is presented in Fig. 1. The seed weight of the cultivars varied amongst the cultivars significantly. The average seed mass was found to be the lowest in Cv. Hysun 39 ( $50.52 \pm 1.055\text{mg}\cdot\text{seed}^{-1}$ ) and the highest in Cv. S-278 ( $81.79 \pm 11.14\text{mg}\cdot\text{seed}^{-1}$ ).

The pooled sampled for the twelve cultivars showed average seed weight to be  $62.45 \pm 0.4352$  mg with variation around 24.124%. This parameter distributed asymmetrically and suffered from some degree of platykurtosis (Fig.2).

Agglomerative clustering based on seed weights of the twelve cultivars with Ward's (1963) method employing Euclidean distances resulted in two discrete clusters (Fig. 3).

Cluster A was composed of five cultivars (Cv. Golden 1, Cv. Agsun 8251, Cv. NK Armani, Cv. Hysun 666 and Cv. S-278) and the Cluster B was the product of agglomeration of seven cultivars namely Cv. Aussie gold 62,

Cv. Aussie gold, Cv. Hysun 39, Cv. Hybrid 1, Cv. Hysun 33, Cv. Aussie gold 61 and Cv. Local. All the three newly studied cultivars (Cv. Golden 1, Cv. Agsun 8251 and Cv. Hysun 666) agglomerated with heavy-seeded cultivars such as Cv. NK Armani and Cv. S-278 (earlier reported cluster). Cluster B was composed of the same cultivars as reported earlier (Fig. 3). The variability in seed size was comparatively higher in this lighter seeded group (23.32%) as compared cluster A (16.29%).

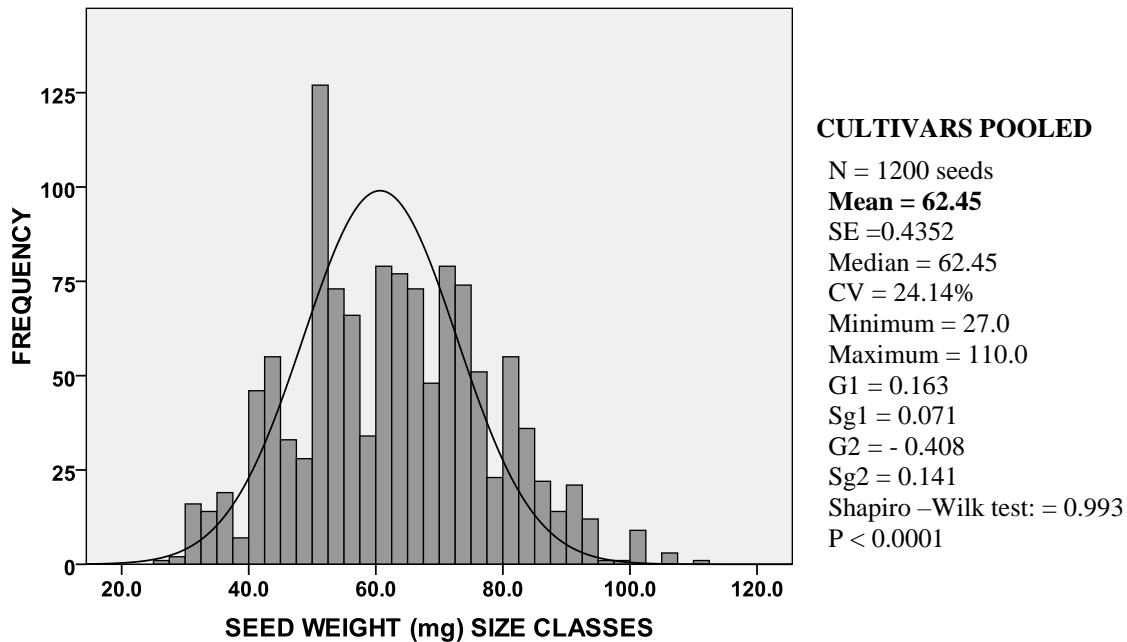


Fig. 2. Frequency distribution of seed weight (mg) for pooled samples of Guar (N = 1200).

Table 1. Location and dispersion parameters of seed weight (mg) in nine sunflower cultivars.

Parameters	Sunflower germplasms											
	Cv1	Cv2	Cv3	Cv4	Cv5	Cv6	Cv7	Cv8	Cv9	CV10	Cv11	Cv12
N	100	100	100	100	100	100	100	100	100	100	100	100
Mean	81.79	57.73	50.520	74.82	54.65	51.40	57.16	56.66	55.95	75.55	64.89	67.95
SE	1.137	1.421	1.055	1.196	1.249	1.145	1.298	1.148	1.134	1.024	0.970	0.781
CV (%)	13.90	24.62	20.75	15.99	22.86	22.27	22.70	21.22	20.27	13.55	14.94	11.50
Median	81.60	55.50	50.40	76.10	53.00	50.40	54.95	55.20	54.55	76.10	66.0	68.0
g1	0.157	0.532	0.870	-0.384	0.556	0.462	0.252	0.76	0.023	-1.31	-0.49	-0.07
g2	-0.39	0.397	-0.252	-0.693	1.267	0.243	-0.49	1.71	-0.69	4.077	0.038	0.543
Min.	57.7	30.4	30.2	46.7	27.80	28.0	30.0	30.5	30.40	27.7	40.0	52.0
Max.	110.0	105.3	72.4	93.9	102.2	84.6	91.7	101.3	85.0	91.9	85.0	87.0
Max / Min	1.91	3.46	2.40	2.01	3.68	3.02	3.06	3.32	2.80	3.32	2.13	1.67
Sh-W test	0.980	0.976	0.982	0.961	0.974	0.978	0.979	0.9677	0.980	0.923	0.974	0.983
p <	0.137	0.069	0.183	0.005	0.043	0.096	0.091	0.015	0.124	0.001	0.045	0.235
Symmetry	S	S	S	AS	AS	S	S	AS	S	AS	AS	S

Sh-W, Shapiro-Wilks test. SE of skewness, Sg1 = 0.241; SE of kurtosis, Sg2 = 0.478.

**Cv1**, S-278; **cv2**, Local; **cv3**, Hysun 39; **cv4**, NK Armoni; **cv5**, Hybrid 1 (Tandojam); **cv6**, Hysun 33; **cv7**, Aussie gold 61; **cv8**, Aussie gold 62; **cv9**, Aussie gold; **Cv10**, Hysun 666; **Cv11**, Golden 1 and **Cv12**, Agsun8251.

Data for Cv1 to Cv9 from Khan *et al.* (2011).

Average seed weight in cluster A was  $73.00 \pm 0.5318$  mg (N = 500), significantly higher than that of cluster B (mean =  $54.35 \pm 0.567$  mg (N = 700)). Although the extreme ranges of seed weight in two clusters didn't vary significantly, the disparity in seed size between the two clusters appeared to be due to the significant differences in strength of the size classes (chi square: 307.09,  $p < 0.001$ ) (Fig. 4).

**H I E R A R C H I C A L C L U S T E R A N A L Y S I S**  
**Dendrogram using Ward Method**  
 Rescaled Distance Cluster Combine

C A S E	0	5	10	15	20	25		
Label	Num	+-----+-----+-----+-----+-----+						
Cv11	11	+-	-----	+	<b>CLUSTER - A</b> <b>Mean = 73.00 ± 0.5318mg, N = 500,</b> <b>Median: 73.50mg</b> <b>27 -110mg, CV= 16.29%</b>			
Cv12	12	+-		+				
cv4	4	-----	+-				<b>A</b>	
Cv10	10	-----	+	+-				
cv1	1	-----	+					
cv8	8	-----	+-					
cv9	9	-----	+	+-				
cv3	3	-----	+	+-				
cv5	5	-----	+	+-				<b>B</b>
cv6	6	-----	+					
cv7	7	-----	+		<b>CLUSTER - B</b> <b>Mean = 54.35 ± 0.567mg, N = 700</b> <b>Median: 52.35mg</b> <b>27.8 – 105. 3mg, CV = 23.32%</b>			
cv2	2	-----	+					

**Cv1**, S-278; **cv2**, Local; **cv3**, Hysun 39; **cv4**, NK Armoni; **cv5**, Hybrid 1 (Tandojam); **cv6**, Hysun 33; **cv7**, Aussie gold 61; **cv8**, Aussie gold 62; **cv9**, Aussie gold; **Cv10**, Hysun666; **Cv11**, Golden 1 and **Cv12**, Agsun8251.

Acronym: CV = Coefficient of variability (%).

**Cluster A** = Cv. Golden 1, Cv. Agsun 8251, Cv. NK Armani, Cv. Hysun 666 and Cv. S-278.

**Cluster B** = Cv. Aussie gold 62, Cv. Aussie gold, Cv. Hysun 39, Cv. Hybrid 1, Cv. Hysun 33, Cv. Aussie gold 61 and Cv. Local.

Fig. 3. Agglomerative clustering of 12 cultivars on the basis of seed weight by the Ward's method using Euclidean distances.

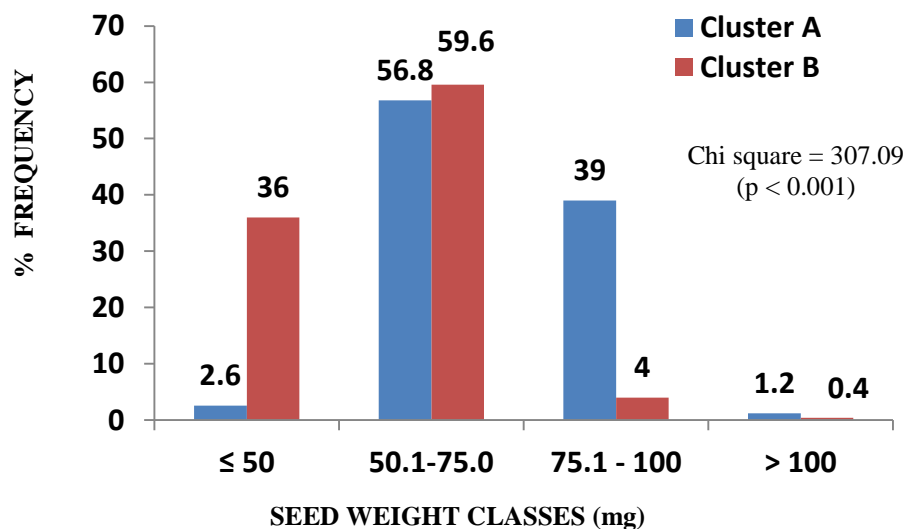


Fig. 4. Seed weight frequency for the selected classes of germplasms belonging to two agglomerative clusters (cluster A, 500 seeds and cluster B, 700 seeds) shown above. The disparity of the classes in two clusters is well evident (Chi Square = 307.09,  $p < 0.001$ ).

## REFERENCES

- Khan, D., M. Anis and M.J Zaki (2011). Seed mass variation in seed lots of nine cultivars of sunflower (*Helianthus annuus* L.). *Int. J. Biol. Biotech.*, 8(2): 263-273.
- Ward, J.H. (1963). Hierarchical grouping to optimize an objective function. *J. Am. Statistical Assoc.*, 58(301): 236-244.

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