

## RESEARCH ARTICLE

# Effect of pollen viability and method of storage on seed set, seed yield and seed quality under *in-vivo* condition of sunflower

■ V. K. DESHPANDE AND PRIYA KIVADASANNAVAR

### SUMMARY

*In vivo* pollen viability studies revealed that there was no significant difference with 100 per cent fresh pollen (61.98) and combination of 75 per cent pollen + 25 per cent mixture and same either as fresh or stored in refrigerator and earthen pot for one day. Application of pollens stored under ambient condition for one day resulted in poor seed set *i.e.* 41.07 to 45.58 per cent. Seed yield as measured setting percentage and 100 seed weight were maximum with cent per cent pollen either as fresh or refrigerator and earthen pot storage. Lower values were recorded in pollen stored at ambient condition for one day.

**Key Words :** Pollen storage, Filler mixture, *In vivo*, Sunflower

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Pollens are most essential and precious genetic material transmitting male gamete in sexual reproduction. Hybrid seed production of sunflower varies from varietal seed production by involving hand emasculatation and pollination. Further, in a hybrid seed

production, early or late flowering (non synchrony of parental lines) of restorer line and snatching of pollens by insects, particularly bees which carry a pollen load of 100 to 120 mg, equal to one half their own body weight (Clements and Long, 1923) resulting in wastage of pollens in turn poor seed set. Hence, there is a need to acquire knowledge of pollen viability, its storage method at farmers level and its further application in hybrid seed production to obtain higher seed yield. It is also observed that lot of pollens will be wasted in regular hand collection and further pollination. Hence, to improve the pollen use efficiency during hand pollination through accurate quantity of pollen application can be also achieved by mixing of inert material or filler mixture (flour) along with essential trace element like boron with fresh pollens.

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Boron stimulates enzymatic activity and nitrogen metabolism which may be linked with improvements in pollen fertility and growth. Shatilov and Ikonnikov (1970) also proved that boron application increased the pollen viability, fertilizing capacity of pollen there by decreased the number of wilted and empty achenes in sunflower.

DSH-1 (DSF-15A X RHA-857) is a newly released sunflower hybrid from University of Agricultural Sciences, Dharwad and little information is available on *in-vivo* performance of pollen viability, germination and storage condition and further it is also of prime importance to understand the performance of different seed vigour combination of parents during hybrid seed production. This type of study has a important role in successful breeding work and seed production.

## MATERIAL AND METHODS

For this study pollen grains were collected in Petriplates at 8.30 am from the plants of RHA-857 with the help of hair brush. Then the pollens were subjected to different storage conditions along with different proportion of pollen grains and filler mixture as mentioned: fresh pollen ( $S_1$ )-  $T_1$  100 %,  $T_2$  75 % pollen + 25 % filler mixture,  $T_3$  50 % pollen + 50 % filler mixture; pollens

stored in ambient condition ( $S_2$ )-  $T_4$  100 %,  $T_5$  75 % pollen + 25 % filler mixture,  $T_6$  50 % pollen + 50 % filler mixture; pollens stored in refrigerator ( $S_3$ ) for one day-  $T_7$  100 %,  $T_8$  75 % pollen + 25 % filler mixture,  $T_9$ ; 50 % pollen + 50 % filler mixture; pollens stored in earthen pot ( $S_4$ ) for one day-  $T_{10}$  100 %,  $T_{11}$  75 % pollen + 25% filler mixture,  $T_{12}$  50 % pollen + 50 % filler mixture. Five plants of DSF-15A were pollinated with the pollens from these treatments. The pollinated plants were covered with cloth bags to prevent out crossing. At the time of harvest, these five plants under each treatment harvested separately. The number of filled seeds and chaffy seeds were counted and weighed. Then seed setting percentage and seed yield per plant was calculated. The experimental data were statistically analysed as per the methods outlined by Panse and Sukatme (1978) and Sundarajan *et al.* (1972) adopting the analysis of variance technique appropriate to the level of treatments and the data were formulated.

## RESULTS AND DISCUSSION

The field performance was observed by the application of pollens stored in different storage conditions with different storage conditions with different

**Table 1 : *In vivo* seed setting (%), seed yield (g) and yield attributing parameters as influenced by pollen storage condition and filler mixture at various proportion**

Storage condition and filler mixture proportion	No. of filled seeds	No. of chaffy seeds	Seed setting (%)	Weight of filled seeds (g)	Weight of chaffy seeds (g)	100 seed weight (g)	Seed yield (g / plant)
$T_1$	292.40	179.40	61.98	16.02	1.80	5.27	16.08
$T_2$	283.00	182.00	60.85	15.35	1.97	5.20	15.85
$T_3$	252.00	196.00	56.24	13.80	2.04	5.10	14.03
$T_4$	218.00	210.00	50.93	11.20	2.21	4.80	12.15
$T_5$	195.00	233.00	45.58	10.72	2.27	4.62	11.90
$T_6$	168.00	241.00	41.07	8.32	2.32	4.38	10.10
$T_7$	289.00	180.60	61.54	15.52	1.87	5.13	15.82
$T_8$	270.00	190.60	58.61	14.38	1.81	5.08	15.76
$T_9$	230.80	200.40	53.52	12.28	2.17	4.98	13.96
$T_{10}$	283.20	181.80	60.90	14.64	1.93	5.10	15.64
$T_{11}$	256.20	186.20	57.90	13.06	1.96	5.02	15.06
$T_{12}$	213.00	201.20	51.41	11.33	1.92	4.90	13.25
Mean	245.1	199.88	54.81	13.01	2.02	4.97	14.13
S.E.±	7.14	5.74	1.57	0.78	0.09	0.20	0.46
C.D. (P=0.05)	20.35	16.35	4.49	2.23	0.26	0.62	1.36

$T_1$  100 % fresh pollen ;  $T_2$  75 % fresh pollen + 25 % filler mixture ;  $T_3$  50 % fresh pollen + 50 % filler mixture;  
 $T_4$  100 % pollen 1 day stored in ambient condition;  $T_5$  75 % pollen + 25 % filler mixture 1 day stored in ambient condition;  
 $T_6$  50 % pollen + 50 % filler mixture 1 day stored in ambient condition;  $T_7$  100 % pollen 1 day stored in refrigerator;  
 $T_8$  75 % pollen + 25 % filler mixture 1 day stored in refrigerator;  $T_9$  50 % pollen + 50 % filler mixture 1 day stored in refrigerator;  
 $T_{10}$  100 % h pollen 1 day stored in earthen pot;  $T_{11}$  75 % pollen + 25 % filler mixture 1 day stored in earthen pot;

proportion of filler mixture (1g borax + 99 g rice flour) on female parent DSF-15A during hybrid seed production of DSH-1. Though the seed setting per cent was significantly higher in T<sub>1</sub> 100 per cent fresh pollen (61.98%) it was statistically at par with 100 per cent pollen stored either in refrigerator (T<sub>7</sub>) or in earthen pot (T<sub>10</sub>) for one day. Similarly 75 per cent pollen with 25 per cent filler mixture either as fresh pollen or stored in refrigerator for one day or stored in earthen pot for one day did not differ significantly with 100 per cent pollen in above mentioned storage conditions for seed setting. But pollen stored in ambient conditions either as 100 per cent or with filler mixture (75+25%) showed poor seed set of 50.93 per cent in T<sub>4</sub>-100 per cent fresh and 45.58 per cent in T<sub>5</sub>, respectively, which revealed the deleterious effect of pollen stored in ambient condition on viability, germination and further fertilization capacity. The lowest seed setting was observed with 50 per cent pollen and 50 per cent mixture (T<sub>12</sub>) stored in ambient condition which significantly differed from pollen stored at earthen pot and refrigerator (Table 1).

Higher seed set and 100 seed weight in above mentioned treatments were also exhibited higher F<sub>1</sub> seed yield. The better performance of 75 % pollen + 25%

filler mixture is attributed due to the role of boron which increased the fertility of pollen grains and increased the filled seeds and decreased wilted achenes and empty achenes (Shatilov and Ikonnikov, 1970) in sunflower. The poor seed set and yield in 50 per cent pollen and 50 per cent filler mixture was attributed due to deleterious effect increased quantity of filler material and boron (Rajshkhar, 2000) as the higher concentration of boron (Shatilov *et al.*, 1979).

Seed quality attributes of F<sub>1</sub> hybrid seeds (DSH-1) as influenced by application of stored pollens either as pollen alone or with filler mixture at different proportions differed significantly. Seeds obtained through application of 100 per cent fresh pollen (T<sub>1</sub>) recorded significantly highest germination, field emergence, speed of germination, seedling length, seedling dry weight which resulted in higher seedling vigour index (Table 2). But the above treatment was at par with one day stored 100 per cent refrigerated pollen in all the quality parameters except vigour index. The quality of seeds obtained through (100%) pollen stored in earthen pot for one day also comparable with above mentioned treatments T<sub>1</sub> and T<sub>7</sub>. The next best treatments were seeds obtained through 75% pollen + 25 % mixture (T<sub>2</sub>, T<sub>8</sub> and T<sub>11</sub>)

**Table 2 : Effect of pollen storage condition and pollen mixture on seed quality attributes in DSH-1 (F<sub>1</sub> hybrid)**

Storage condition and filler mixture proportion	Germination (%)	Speed of germination	Shoot length (cm)	Root length (cm)	Seedling vigour index	Seedling dry weight (mg)	Field emergence (%)	Electrical conductivity (dS/m)
T <sub>1</sub>	96.66(79.59)	55.82	13.38	14.05	2651	23.89	91.00(72.61)	1.846
T <sub>2</sub>	94.33(76.31)	53.53	12.88	13.52	2490	23.72	89.00(70.68)	1.849
T <sub>3</sub>	91.66(73.23)	50.86	12.71	12.52	2312	23.19	87.00(68.90)	1.866
T <sub>4</sub>	89.66(71.89)	49.14	12.44	13.06	2286	23.26	82.00(64.90)	1.908
T <sub>5</sub>	87.33(69.12)	47.00	11.76	12.34	2104	22.88	78.00(62.03)	1.917
T <sub>6</sub>	83.00(65.65)	43.00	11.33	11.56	1872	22.62	74.00(59.34)	1.929
T <sub>7</sub>	95.00(77.12)	54.32	13.75	13.92	2581	23.84	90.00(71.70)	1.857
T <sub>8</sub>	93.33(75.10)	51.98	12.74	13.38	437	23.70	87.00(68.95)	1.871
T <sub>9</sub>	90.33(71.92)	48.79	12.24	12.86	2267	23.00	85.00(67.28)	1.878
T <sub>10</sub>	94.00(75.85)	53.04	12.71	13.89	2500	23.75	88.00(68.77)	1.882
T <sub>11</sub>	92.00(73.59)	51.14	12.51	13.26	2370	23.68	85.00(67.24)	1.887
T <sub>12</sub>	89.00(70.68)	48.25	11.76	12.34	2144	22.95	83.00(65.65)	1.891
Mean	91.35(67.44)	50.57	12.51	13.05	2234	23.65	84.91(61.95)	1.872
S.E.±	0.82	0.361	0.14	0.11	23.59	0.16	1.268	0.47
C.D. (P=0.05)	2.48	1.08	0.42	0.33	70.77	0.46	3.80	NS

T<sub>1</sub> 100 % fresh pollen ; T<sub>2</sub> 75 % fresh pollen + 25 % filler mixture ; T<sub>3</sub> 50 % fresh pollen + 50 % filler mixture;  
 T<sub>4</sub> 100 % pollen 1 day stored in ambient condition; T<sub>5</sub> 75 % pollen + 25 % filler mixture 1 day stored in ambient condition;  
 T<sub>6</sub> 50 % pollen + 50 % filler mixture 1 day stored in ambient condition; T<sub>7</sub> 100 % pollen 1 day stored in refrigerator;  
 T<sub>8</sub> 75 % pollen + 25 % filler mixture 1 day stored in refrigerator; T<sub>9</sub> 50 % pollen + 50 % filler mixture 1 day stored in refrigerator;  
 T<sub>10</sub> 100 % h pollen 1 day stored in earthen pot; T<sub>11</sub> 75 % pollen + 25 % filler mixture 1 day stored in earthen pot;  
 T<sub>12</sub> 50 % pollen + 50 % filler mixture 1 day stored in earthen pot;

NS= Non-significant

which recorded better quality but declined values as compared to T<sub>1</sub>, T<sub>7</sub> and T<sub>10</sub>. The seed quality parameters of these seeds obtained through 50 : 50 proportion of pollen and filler mixture was lowest in T<sub>6</sub> and T<sub>12</sub>, but better in case of T<sub>3</sub> and T<sub>9</sub>. The higher germination percentage and higher vigour index is attributed to better filled seeds with abundant have exhibited better seedling vigour, seedling dry weight and field emergence.

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