Indian Journal of Agricultural Sciences 64 (7) : 450–3, July 1994

Dormancy in parental lines of sunflower (*Helianthus annuus*) seeds and its alleviation

GURMIT SINGH[1], R K BAJAJ[2], G S SANDHA[3] and H L SHARMA[4]

Punjab Agricultural University, Ludhiana 141 004

Received: 17 February 1993

ABSTRACT

An experiment was conducted on sunflower (*Helianthus annuus* L.) seed of autumn crop (harvested in January 1991) to study dormancy in parental lines and its alleviation. Nine genotypes including A (male-sterile), R (restorer) and B (maintainer) lines of new hybrids were screened for determining seed-dormancy period. Genotypic response for dormancy period was observed with 'RHA 274' (15–30 days); 'RHA 83R6', 'RHA 297' and '234 B' (31–45 days); '207 B' (46–60 days); 'RHA 6D1' and 'RHA 856' (61–75 days) and 'RHA 272' and '86 B 3' (76–90 days). Soaking of the dormant seeds in water and solutions of potassium nitrate (KNO_3 200 ppm), thiourea (100, 200 and 500 ppm), ethrel (100, 250 and 500 ppm) and GA_3 (100, 250 and 500 ppm) for 24 hr improved the seed germination by 69.6–86.6; 66–81.6; 65–80; 70.0–86.6 and 78–95% respectively. Soaking of seeds in GA_3 at all concentrations provided the highest germination (%). However, the minimum germination standard (70%) could be achieved by soaking in water for 24 hr.

Seed production of parental lines and their F_1 hybrids in sunflower (*Helianthus annuus* L.) many a times becomes difficult due to seed dormancy. The crop is sown in more than 1 season in north India, thus allowing a very short period between its harvest and successive sowing. Sunflower varieties show seed dormancy of different durations (Udaya Kumar and Krishna Sastry 1975, Dighe and Patil 1980, Cseresnyes 1979, Srivastava and Dey 1982, Cseresnyes *et al.* 1987, Krishna Murthy 1990, Singh *et al.* 1990). However, information on the seed dormancy of parental lines and their F_1 hybrids is lacking, which is essential to have uniform stands for optimal yield. In this study information was generated on the dormancy periods in different A, B and R lines and methods to overcome seed dormancy in sunflower.

[1]Assistant Plant Physiologist, [4]Senior Plant Breeder, Department of Seed Science and Technology; [2]Millet Breeder, [3]Senior Oilseed Breeder, Depart- ment of Plant Breeding

MATERIALS AND METHODS

The experiment was conducted on the autumn crop at Ludhiana. Freshly harvested seeds of different genotypes including 'RHA 83R6', 'RHA 297', 'RHA 6D1', 'RHA 272', '86B3', '234 B', '207 B', 'RIIA 5856' and 'RHA 274' were germinated in triplicate of 100 seeds each in rolled paper-towels at 25 $\pm$ 1°C in the dark in a biological oxygen-demand (BOD) incubator at 15-day intervals to determine the dormancy period. The seeds of 6 genotypes ('RHA 6D1', 'RHA 272', '86 B3', '207 B', 'RHA 5856' and 'RHA 271') were dipped in water or solutions of KNO_3 (200 ppm), GA_3 (100, 250 and 500 ppm), thiourea

(100, 250 and 500 ppm) and ethrel (100, 250 and 500 ppm) for 24 hr at 25 ± 1°C in a BOD incubator. The treatments were effected within a month of harvest. After the required treatment the seeds were rinsed in tap-water and dried at room temperature for 24 hr. The data on germination (%) were recorded 7 days after placing the seeds for germination.

RESULTS AND DISCUSSION

Sunflower showed genotypic differences for length of seed dormancy after harvest (Table 1). Genotype 'RHA 274' showed the shortest dormancy period (15–30 days), followed by 'RHA 83R6', 'RHA 297' and '234 B' (31–45 days), '207 B' (46–60 days), and 'RHA 6D1' and 'RHA 5856' (61–75 days). 'RHA 272' and '86B3' showed the maximum dormancy period (76–90 days). No such information is available on the parental lines of sunflower hybrids. However, Mehrotra *et al.* (1978) reported seed dormancy period (15–55 days) in sunflower varieties.

Seed germination in all the genotypes increased with increase in storage. It indicates that the dormancy is overcome with passage of time after harvest. However, due to sudden demand and successive sowing it is necessary to devise means to overcome dormancy. Udaya Kumar and Krishna Sastry (1975) and Srivastava and Dey (1982) were able to overcome dormancy of sunflower seeds with exogenous application of ethrel, benzyl adenine and GA_3; ethrel at 25 ppm being the most effective. In our study germination of seeds of 'RHA 6D1', 'RHA 272', '86B3', '207 B', 'RHA 5856' and 'RHA 271' improved with soaking in water, KNO_3 (200 ppm), GA_3 (100, 250, 500 ppm), thiourea (100, 250 and 500 ppm) and ethrel (100, 250 and 500 ppm) (Table 2). Soaking in water alone could help overcome seed dormancy to achieve minimum germination standard (70% in sunflower). However, soaking in GA_3 and ethrel significantly increased it compared with that in water.

Zimmerman and Zimmer (1978) reported that sunflower plant exposed to freezing temperature produced dormant seeds. Seeds of different sunflower varieties ripen 11–18 days after physiological maturity. Udaya

Table 1 Germination (%) in different genotypes of sunflower on different days after harvest

Genotype	Days after harvest					
	15	30	45	60	75	90
'RHA 83R6'	43.3	62.6	80.6	95.3	92.0	92.0
'RHA 6D1'	3.3	18.6	60.0	64.6	74.3	86.0
'RHA 297'	38.0	64.3	74.0	92.0	84.6	85.6
'RHA 272'	8.3	32.3	34.3	57.3	62.6	90.6
'86B 3'	1.6	22.0	54.0	60.0	68.3	92.6
'234 B'	61.6	63.0	72.6	74.6	76.0	82.6
'207 B'	38.3	52.0	63.3	79.3	86.0	86.6
'RHA 5856'	11.6	30.6	39.3	66.6	74.0	92.0
'RHA 274'	58.3	80.3	88.0	90.0	92.0	92.0

Table 2 Effect of 24 hr soaking of seeds in water, KNO_3, GA_3, thiourea and ethrel on alleviating seed dormancy in sunflower

Treatment	Germination (%) at 30 days after harvest					
	'RHA 6D1'	'RHA 271'	'RHA 273'	'86B 3'	'207 B'	'RHA 5856'
Control	26.6	32.6	28.6	35.6	41.6	38.3
Water	69.6	78.6	73.3	68.0	73.3	86.6
KNO_3 200 ppm	81.6	76.0	80.0	73.3	66.0	81.6
GA_3 (ppm)						
500	90.0	84.6	90.0	88.3	80.0	95.0
250	86.6	84.6	80.0	91.3	78.3	91.6
100	78.3	78.0	83.0	81.6	80.0	81.6
Thiourea (ppm)						
500	75.0	65.6	65.0	78.0	75.0	80.0
250	80.0	72.3	75.0	80.0	78.3	80.0
100	76.6	71.0	66.0	76.6	80.0	76.6
Ethrel (ppm)						
500	77.0	78.0	86.0	81.6	73.3	84.3
250	73.3	86.6	78.0	75.0	78.3	78.6
100	70.0	73.3	80.3	76.6	72.3	76.3
CD ($P = 0.05$)	4.3	3.5	3.6	3.9	3.3	4.1

Kumar and Krishna Sastry (1975) reported that 10 days after crop harvest the seeds on dehusking showed 75% germination, indicating that the factor responsible for dormancy was present in the seed-coat. In our experiment the extract collected 24 hr after soaking sunflower seed in water delayed the seed germination in turnip [*Brassica rapa* L. ssp *rapa* DC., syn *B. campestris* L. ssp *rapifera* (Metzger) Sinsk.] and radish (*Raphanus sativus* L.). On day 1 no seed germinated in seed extract compared with the water, where more than 90% seed germination could be recorded. Germination of radish (92%) and turnip (91%) seeds was also inhibited in the sunflower-seed extract, compared with 100% germination in water.

Soaking in water and other solutions for 24 hr does not cause any seed sprouting. The storage of soaked seeds after drying was also verified to detect any kind of soaking injury. The seeds stored for 14 days after soaking showed 84% germination compared with 82% germination when tested 24 hr after drying, after the soaking treatment. This indicates no soaking injury in the seeds. Therefore it is safe to soak the sunflower seed in water for 24 hr (and in other solutions) to overcome its dormancy, to allow enough time for sowing.

REFERENCES

Cseresnyes Z. 1979. Studies on the duration of dormancy and methods of determining and germination of dormant seeds of *Helianthus annuus*. *Seed Science and Technology* 7 (3) : 179–88.

Cseresnyes Z, Baleassu M, Popescu S, Danielescu S and Pusca C. 1987. Studies on the length of dormancy in sunflower and methods of determining germination in dormancy. *Probleme de genetica theoretica science applicata* 19 : 135–44.

Dighe R S and Patil V N. 1980. A note on dormancy and the relationship of some seed characters with germination. *Seed Research* 8 (1) : 91–3.

Krishna Murthy K S. 1990. 'Seed dormancy studies in sunflower — Physiological basis of, and interaction

between maternal and embryo tissues over seed dormancy.' M Sc thesis, University of Agricultural Sciences, Bangalore (unpublished).

Mehrotra O N, Mahesh Pal and Singh G S. 1978. Studies on post-harvest dormancy in sunflower seeds. *Seed Research* **6** (1) : 91–3.

Singh A R, Rao T S and Borikar S T. 1990. Seed dormancy and quality in relation to seed development and maturity in the sunflower. *Seed Research* **18** (2) : 121–5.

Srivastava A K and Dey S D. 1982. Physiology of seed dormancy in sunflower. *Acta agronomica Academiae scientiarum hungaricae* **31** (1) : 70–81.

Udaya Kumar M and Krishna Sastry K S. 1975. Effect of growth regulators on germination of dormant sunflower seeds. *Seed Research* 3 (2) : 61–5.

Zimmerman and Zimmer D E. 1978. Influence of harvest date and freezing on sunflower seed germination. *Crop Science* **18** (3) : 479–81.