Indian J. Genet., **67**(1): 101-102 (2007)

Short Communication

Evaluation of surf excel — A detergent as chemical hybridizing agent in radish (*Raphanus sativus* L.)

D. K. Agnihotri, Neeta Singh and S. V. S. Chauhan

Department of Botany, School of Life Sciences, Dr. B. R. Ambedkar University, Agra 282 002

(Received: June 2006; Revised: September 2006; Accepted: September 2006)

Surf excel, a popular synthetic detergent commonly used for removing all kinds of dirts, consists of surface-active agents, builders (phosphates) and fillers. In addition, it has additives e.g. anti deposition agents, optical brighteners, bluing agent, bleaching agent, foam regulator, organic sequestering agent and enzyme. It has been successfully used as a chemical hybridizing agent for some crops e.g., *Nicotiana tabacum* [1] and *Capsicum annuum*, *Lycopersicon esculentum* and *Abelmoschus esculentus* [2]. Therefore, present experiment was conducted for testing surf excel as a chemical hybridizing agent in radish (*Raphanus sativus* L.) var. Hill Queen. The seeds of this variety obtained from National Seed Corporation, Agra were sown at Agra. The experiment was laid out in a randomized row design with five replicates with ninety plants each. The distance between row to row was 75 cm and between plant to plant it was 45 cm. The plants were sprayed with aqueous solutions of 0.5, 1.0 and 1.5% (w/v) surf excel. Ninety plants were sprayed a week before the initiation of first floral buds (T_1). Leaving a group of 30 plants after first treatment, the remaining 60 plants were sprayed again at the time of floral bud initiation (T_2). Again after leaving a group of 30 plants, the other 30 were sprayed at the time of anthesis, thus receiving three sprays (T3). A group of 90 plants were sprayed with distilled water to serve as control (T_0). 30 ml of each concentration was sprayed on one plant to run off. Pollen fertility of treated and untreated (control) plants was checked at regular intervals with the help of Alexander's staining technique [3]. Data on the number of flowers and fruits/plant, fruit size, number of seeds/fruit and total yield in treated and control plants were collected and statistically analyzed by analysis of variance (ANOVA).

Number of flowers/plant: There was a significant reduction in the number of flowers/treated plants. The number of flowers/plant gradually decreased with the increase in concentrations and number of treatments. However, in the plants treated once with 0.5% surf excel, the reduction in number of flowers/plant was insignificant. (501.7-flowers/treated plant) as compared to untreated plants (510.2 flowers/plant). Maximum reduction (399.1flowers/plant) was recorded in plants treated thrice (T_3) with 1.5% surf excel (Table 1).

Pollen sterility: Foliar applications of different concentrations of surf excel significantly induced pollen sterility ranging between 91.8-100% (Table 1). Plants sprayed twice (T_2) and thrice (T_3) with 1.0 and 1.5% surf excel induced 100% pollen sterility lasting for 20-25 days. Surf excel has been effectively used in inducing complete pollen sterility in various crops e.g. *Nicotiana tabacum*, *Capsicum annuum*, *Lycopersicon esculentum*, *Abelmoschus esculenthus* [2], *Viciafaba* [4], *Helianthus annuus* [5] and *Brassica juncea* [6].

Number of fruits/plant: There was a significant reduction in the number of fruits/treated plants and the reduction was directly proportional to the increase in the concentration and number of treatments. The maximum reduction (360.9 fruits/plant) was recorded in plants treated thrice (T_3) with 1.5% surf excel. However, the plants treated once with 0.5% surf excel, exhibited insignificant reduction in number of fruits/plant (463.9 fruits/plant) as compared to untreated plants (468.8 fruit/ untreated plant) (Table 1).

Fruit size: All the treated plants showed significantly reduction in fruit size which was directly proportional to the increase in the concentrations as well as number of treatments. Maximum reduction in fruit size was recorded in plants treated thrice (T_3) with 1.5% surf excel. The average fruit size in 1. 5% surf excel treated plants was 2.9 cm as compared to 5.0 cm long fruits in untreated plants (Table 2).

Number of seeds/fruit: There was a reduction in the number of seeds/fruit in variously treated plants and the reduction was directly proportional to the number of treatments and concentration of the detergent. However, the reduction in the number of seeds/fruit in plants sprayed once (T_1), twice (T_2) or thrice (T_3) with 0. 5% surf excel was insignificant and there were 4.6 seeds/fruit in plants receiving three treatments as compared to 6.4 seeds/fruit of control plant (Table 2). This may be attributed to ovular sterility induced by the treatments with surf excel. Earlier studies have also shown considerable extent of ovular sterility and reduction in the number of seeds/fruit in plants treated with surf excel [1].

Table 1. Effect of surf excel on number of flowers/plant, pollen sterility and number of fruits/plant in radish var. Hill Queen

Treatment	Conc. (%)	Number of flowers/plant			Pollen sterility (%)			Number of fruits/plant		
Number of treatments		T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3
	0.5	501.7±3.2	491.0*±2.1	450.9*±2.1	91.8*±2.1	94.2*±2.0	100*±0.0	463.9±3.2	450.2*±2.6	408.8*±2.2
Surf excel	1.0	499.9*±3.2	480.1*±1.6	470.1*±1.5	98.9*±1.6	100*±0.0	100*±0.0	449.4*±2.1	429.4*±1.9	409.6*±1.9
	1.5	434.1*±2.1	419.1*±4.3	399.1*±5.2	98.9*±1.0	100*±0.0	100*±0.0	400.4*±1.8	391.1*±1.7	360.9*±1.7
Control			510.2±3.1			2.1±1.2			468.8±2.9	
CD value at 5% level			61.2			0.89			60.7	

*Significant value at 5% level; T_1: Single spray, T_2: Two sprays, T_3: Three sprays, T_0: Control plants sprayed with distilled water

Total yield/plant: There was a significant reduction in the total yield in variously treated plants and the reduction was directly proportional to the number of treatments as well as concentrations (Table 2). However, in the plants treated only once with 0.5% surf excel, there was insignificant reduction in total yield (426.7g/plant) as compared to untreated plants (430.8 g/plant). The maximum reduction in total yield was recorded in plants treated thrice (T_3) with 1.5% surf excel (300.1g/plant) as compared to 430.8g/ untreated plant. The reduction in yield in treated plants may be attributed to the reduction in the number of fruits/plant, fruit size and number of seeds/fruit and this may be largely due to ovular sterility induced by the treatments of surf excel as reported in several other crops [4-6].

Table 2. Effect of treatments with surf excel on fruit size, number of seeds/fruit and total yield/plant in radish var. Hill Queen

Chemical	Concentrations (%)	Fruit size (cm)			Number of seeds/fruit			Total yield/plant(g)		
Treatments		T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3
	0.5	4.4*±1.0	4.1*±1.2	3.8*±1.0	6.0±2.7	5.8±1.8	5.8±1.9	426.7±2.1	380.0*±2.6	350.0*±2.2
Surf excel	1.0	4.1*±1.1	3.8*±1.3	3.3*±1.2	5.5*±2.3	5.1*±1.4	5.1*±1.8	380.0*±2.1	375.0*±1.7	360.0*±1.4
	1.5	3.8*±1.2	3.2*±1.0	2.9*±2.1	5.0*±1.7	4.6*±1.4	4.6*±1.5	340.8*±1.5	320.0*±1.4	300.1*±1.4
Control		5.0±1.1			6.4±3.1			430.8±2.1		
CD value at 5% level				0.58			1.0	41.0		

*Significant value at 5% level; T_1: Single spray, T_2: Two sprays, T_3: Three sprays, T_0: Control plants sprayed with distilled water

From the foregoing observations it is evident that all the treatments with surf excel at different concentrations are capable of inducing complete pollen sterility in radish. Recent studies conducted in this laboratory have clearly shown that abortion of pollen in surf excel treated plants is associated with tapetal abnormalities similar to those recorded in cytoplasmic, genie and chemically induced male sterile plants [2]. Our recent studies have clearly demonstrated association of abnormal behaviour of tapetal mitochondria and suppression of tapetum specific genes with pollen abortion in surf excel treated *Brassica juncea* [6]. Induced pollen sterility is associated with the reduction various yield parameters. This may be largely due to reduction in the number of flowers, fruits/treated plant and number of seeds/fruit mainly owing to ovular sterility. However, the plants sprayed thrice with the lowest concentration (0.5%) of surf excel exhibited 100% pollen sterility associated with minimum reduction in yield parameters. Thus, these plants can be effectively used for hybrid seed production in radish by keeping a beehive in the field as has been successfully done in *Brassica juncea* [6].

References

1. **Agnihotri D. K. and Chauhan S. V. S.** 2004. Induction of male sterility in *Nicotiana tabacum* L. by the treatments with a detergent-Surf excel. National J. Life Sci., **1**: 11-14.
2. **Chauhan S. V. S. and Agnihotri D. K.** 2005. Detergent induced pollen sterility in some vegetable crops. International J. Hort. Sci., **1**: 85-88.
3. **Alexander M. P.** 1980. A versatile stain for pollen, fungi, yeast and bacteria. Stain Tech., **55**: 13-18.
4. **Chauhan S. V. S. and Chauhan S.** 2003. Evaluation of three chemical hybridizing agents on two varieties of broad beans (*Vicia faba* L.). Indian J. Genet., **63** 128-131.
5. **Singh V. and Chauhan S. V. S.** 2000. Effect of various chemical hybridizing agents on *Helianthus annuus* L., J. Indian Bot. Soc., **79**: 71-74.
6. **Chauhan S. V. S. and Singh V.** 2006. Chemical induction of male sterility in [*Brassica juncea* (L.) Czern & Coss] and its utilization in hybrid seed production. Brassica, **8**: 111-124.