TABLES

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Table 1. Effect of accelerated ageing and seed pretreatment with Na-dikegulac (DK) on leaching of soluble carbohydrate (mg/g/20 ml) from seeds of a few cultivars.

Seeds were presoaked with 0, 1000, 2000 and 4000 µg/ml DK for 6 h and then dried back to their original moisture levels. This was repeated three times in close succession. The pretreated seed lots were then subjected to accelerated ageing treatment under 98.2% RH in a desiccator. Data were recorded from the seed leachate at 7-day intervals after immersing 1 g seed sample of each cultivar in 20 ml deionised distilled water for 16 h.

Cultivars	Pretreatments (µg/ml)	Days after accelerated ageing			
		0	7	14	21
Gram	DK 0	2.88	4.45	8.98	9.12
	DK 1000	2.95	4.06	6.20	7.45
	DK 2000	2.95	3.92	5.95	7.22
	DK 4000	3.14	4.18	5.88	7.04
	LSD (P=0.05)	0.14	0.32	0.70	0.72
Soybean	DK 0	7.08	13.62	22.30	24.50
	DK 1000	7.18	12.15	17.25	21.42
	DK 2000	7.39	11.28	16.55	19.80
	DK 4000	7.56	12.30	16.08	19.62
	LSD (P=0.05)	0.45	1.05	1.95	2.01
Sunflower	DK 0	2.37	4.80	7.38	8.55
	DK 1000	2.42	3.95	5.05	6.24
	DK 2000	2.45	3.80	4.80	5.90
	DK 4000	2.56	4.10	4.78	5.88
	LSD (P=0.05)	0.15	0.37	0.58	0.65
Safflower	DK 0	2.18	4.56	6.69	7.25
	DK 1000	2.24	3.58	5.18	5.25
	DK 2000	2.25	3.40	4.88	4.86
	DK 4000	2.40	3.35	4.72	4.80
	LSD (P=0.05)	0.12	0.30	0.60	0.55

Table 2. Effect of accelerated ageing and seed pretreatment with Na-dikegulac (DK) on leaching of free amino acids (mg/g/20 ml) from seeds of a few cultivars.

Treatments are the same as in Table 1. Data were recorded from the same seed leachate at 7-day intervals up to 3 weeks of accelerated ageing.

Cultivars	Pretreatments (µg/ml)	Days after accelerated ageing			
		0	7	14	21
Gram	DK 0	1.43	2.71	5.69	10.05
	DK 1000	1.47	2.45	4.12	8.18
	DK 2000	1.52	2.05	3.96	7.32
	DK 4000	1.55	2.20	3.90	7.09
	LSD (P=0.05)	NS	0.16	0.42	1.01
Soybean	DK 0	2.68	5.02	10.85	25.50
	DK 1000	2.78	4.15	8.52	20.80
	DK 2000	2.86	3.80	7.45	17.98
	DK 4000	2.95	3.98	7.28	17.05
	LSD (P=0.05)	0.16	0.38	0.88	1.70
Sunflower	DK 0	0.95	1.70	3.67	9.52
	DK 1000	1.04	1.50	3.05	7.05
	DK 2000	1.10	1.39	2.80	6.67
	DK 4000	1.08	1.48	2.73	6.60
	LSD (P=0.05)	0.09	0.12	0.30	0.80
Safflower	DK 0	0.30	0.58	1.23	3.12
	DK 1000	0.35	0.48	1.00	2.40
	DK 2000	0.40	0.46	0.95	2.15
	DK 4000	0.40	0.45	0.91	2.06
	LSD (P=0.05)	0.05	0.04	0.09	0.19

NS, Not significant

Table 3. Effect of accelerated ageing and seed pretreatment with Na-dikegulac (DK) on protein (mg/g wet weight) contents of the seeds of a few cultivars.

Treatments are the same as in Table 1. Data were recorded from seed kernels at 7-day intervals up to 3 weeks of accelerated ageing.

Cultivars	Pretreatments (µg/ml)	Days after accelerated ageing			
		0	7	14	21
Gram	DK 0	138.7	99.0	89.4	81.5
	DK 1000	132.6	105.7	97.8	88.7
	DK 2000	126.8	105.0	101.6	91.9
	DK 4000	124.9	100.9	98.7	93.5
	LSD (P=0.05)	NS	NS	8.60	7.06
Soybean	DK 0	190.8	135.5	120.6	105.8
	DK 1000	182.8	143.4	133.8	118.8
	DK 2000	170.6	139.8	136.0	125.7
	DK 4000	167.5	132.6	128.5	126.0
	LSD (P=0.05)	17.58	NS	10.08	10.12
Sunflower	DK 0	88.5	72.9	61.5	53.1
	DK 1000	84.7	76.7	70.5	61.8
	DK 2000	78.8	74.0	72.0	64.3
	DK 4000	78.0	75.2	69.3	66.0
	LSD (P=0.05)	7.80	NS	6.07	4.88
Safflower	DK 0	83.31	64.6	52.3	49.5
	DK 1000	78.5	71.5	62.8	57.0
	DK 2000	76.7	68.8	65.0	61.5
	DK 4000	76.2	68.6	65.6	63.0
	LSD (P=0.05)	NS	NS	5.85	5.88

NS, Not significant

Table 4. Effect of accelerated ageing and seed pretreatment with Na-dikegulac (DK) on RNA (µg/g wet weight) contents of the seeds of a few cultivars.

Treatments are the same as in Table 1. Data were recorded from seed kernels at 7-day intervals up to 3 weeks of accelerated ageing.

Cultivars	Pretreatments (µg/ml)	Days after accelerated ageing			
		0	7	14	21
Gram	DK 0	995.4	843.5	626.0	562.4
	DK 1000	962.8	890.0	765.8	672.8
	DK 2000	950.5	900.5	798.0	695.6
	DK 4000	943.8	885.4	780.8	692.0
	LSD (P=0.05)	NS	NS	68.08	54.98
Soybean	DK 0	658.8	549.8	409.2	379.2
	DK 1000	641.7	597.5	501.0	462.7
	DK 2000	630.5	605.2	526.6	490.5
	DK 4000	621.6	588.6	518.0	478.7
	LSD (P=0.05)	NS	52.05	49.18	40.08
Sunflower	DK 0	935.8	781.8	594.9	522.7
	DK 1000	902.7	835.6	682.7	608.2
	DK 2000	887.6	847.0	728.2	647.4
	DK 4000	875.5	840.8	707.5	625.6
	LSD (P=0.05)	NS	60.28	62.50	54.72
Safflower	DK 0	833.5	699.8	541.2	465.6
	DK 1000	810.0	737.0	619.5	548.8
	DK 2000	786.8	749.9	638.9	580.5
	DK 4000	773.9	735.5	628.0	559.2
	LSD (P=0.05)	NS	NS	49.90	48.88

NS : Not significant

Table 5. Effect of accelerated ageing and seed pretreatment with Na-dikegulac (DK) on soluble carbohydrate (mg/g wet weight) contents of the seeds of a few cultivars.

Treatments are the same as in Table 1. Data were recorded from seed kernels at 7-day intervals up to 3 weeks of accelerated ageing.

Cultivars	Pretreatments (µg/ml)	Days after accelerated ageing			
		0	7	14	21
Gram	DK 0	22.5	26.8	40.8	36.6
	DK 1000	25.0	26.2	35.0	28.5
	DK 2000	27.0	27.8	32.8	27.6
	DK 4000	26.8	27.5	29.9	27.0
	LSD (P=0.05)	2.18	NS	3.28	2.08
Soybean	DK 0	35.0	40.6	58.7	51.4
	DK 1000	37.7	39.0	47.7	44.5
	DK 2000	40.5	42.1	45.6	42.7
	DK 4000	40.7	42.5	45.0	41.9
	LSD (P=0.05)	3.25	NS	4.32	3.70
Sunflower	DK 0	24.8	29.4	43.8	38.5
	DK 1000	26.2	27.5	38.9	33.9
	DK 2000	29.0	29.8	32.8	33.0
	DK 4000	29.5	30.6	31.7	31.2
	LSD (P=0.05)	2.03	2.70	3.08	2.54
Safflower	DK 0	21.5	24.3	38.7	35.5
	DK 1000	25.6	27.0	33.0	31.6
	DK 2000	27.3	28.7	31.5	29.0
	DK 4000	27.9	28.9	30.2	28.4
	LSD (P=0.05)	1.98	2.66	2.98	2.66

NS : Not significant

Table 6. Effect of accelerated ageing and seed pretreatment with Na-dikegulac (DK) on insoluble carbohydrate (mg/g wet weight) contents of the seeds of a few cultivars.

Treatments are the same as in Table 1. Data were recorded from seed kernels at 7-day intervals up to 3 weeks of accelerated aegeing.

Cultivars	Pretreatments (µg/ml)	Days after accelerated ageing			
		0	7	14	21
Gram	DK 0	25.9	23.8	18.9	15.8
	DK 1000	23.0	22.4	21.0	17.6
	DK 2000	20.9	20.0	19.2	18.8
	DK 4000	20.4	19.8	19.0	18.0
	LSD (P=0.05)	2.08	2.20	1.87	1.60
Soybean	DK 0	150.6	139.0	114.4	100.0
	DK 1000	143.7	138.5	125.9	117.9
	DK 2000	130.9	128.0	123.0	119.5
	DK 4000	128.0	126.9	123.9	121.0
	LSD (P=0.05)	12.18	12.15	8.52	9.08
Sunflower	DK 0	28.7	26.5	18.0	16.0
	DK 1000	20.5	18.9	18.5	18.0
	DK 2000	20.0	19.0	18.4	17.8
	DK 4000	19.4	19.3	19.0	18.4
	LSD (P=0.05)	1.98	2.05	NS	1.40
Safflower	DK 0	24.4	22.0	16.5	12.5
	DK 1000	22.5	21.7	18.9	15.2
	DK 2000	21.0	20.1	19.0	17.5
	DK 4000	17.2	16.9	16.2	15.8
	LSD (P=0.05)	2.01	1.90	1.50	1.49

NS : Not significant

Table 7. Effect of accelerated ageing and seed pretreatment with Na-dikegulac (DK) on percentage TTC-stained seeds of a few cultivars.

Treatments are the same as in Table 1. Data were recorded at 7-day intervals up to 3 weeks of accelerated ageing.

Cultivars	Pretreatments (µg/ml)	Days after accelerated ageing			
		0	7	14	21
Gram	DK 0	100	100	80	40
	DK 1000	100	100	88	60
	DK 2000	100	100	95	62
	DK 4000	100	100	95	62
	LSD (P=0.05)	NC	NC	8.00	5.50
Soybean	DK 0	90	85	60	40
	DK 1000	90	88	75	56
	DK 2000	90	90	80	58
	DK 4000	90	87	80	55
	LSD (P=0.05)	NC	NS	5.95	4.44
Sunflower	DK 0	80	70	58	50
	DK 1000	80	78	75	59
	DK 2000	80	75	72	65
	DK 4000	80	78	74	65
	LSD (P=0.05)	NC	6.98	5.88	6.08
Safflower	DK 0	85	75	40	36
	DK 1000	85	80	66	62
	DK 2000	85	80	70	65
	DK 4000	85	78	70	60
	LSD (P=0.05)	NC	NS	5.54	4.88

NS : Not significant ; NC : Not calculated.

Table 8. Effect of accelerated ageing and seed pretreatment with Na-dikegulac (DK) on dehydrogenase (expressed as △OD/g wet weight/ml) activity of the seeds of a few cultivars.

Treatments are the same as in Table 1. Data were recorded at 7-day intervals up to 3 weeks of accelerated ageing.

Cultivars	Pretreatments (µg/ml)	Days after accelerated ageing			
		0	7	14	21
Gram	DK 0	0.72	0.65	0.58	0.40
	DK 1000	0.69	0.68	0.64	0.55
	DK 2000	0.68	0.69	0.66	0.58
	DK 4000	0.70	0.65	0.63	0.54
	LSD (P=0.05)	NS	NS	0.059	0.045
Soybean	DK 0	0.66	0.58	0.42	0.30
	DK 1000	0.67	0.64	0.55	0.42
	DK 2000	0.64	0.64	0.53	0.46
	DK 4000	0.64	0.60	0.51	0.41
	LSD (P=0.05)	NS	0.057	0.044	0.036
Sunflower	DK 0	0.54	0.48	0.40	0.32
	DK 1000	0.56	0.52	0.47	0.36
	DK 2000	0.56	0.53	0.48	0.41
	DK 4000	0.54	0.49	0.48	0.39
	LSD (P=0.05)	NS	0.040	0.039	0.033
Safflower	DK 0	0.55	0.50	0.34	0.27
	DK 1000	0.55	0.52	0.45	0.39
	DK 2000	0.53	0.55	0.48	0.39
	DK 4000	0.54	0.53	0.45	0.38
	LSD (P=0.05)	NS	0.045	0.035	0.033

NS : Not significant

Table 9. Effect of accelerated ageing of sunflower seeds, pretreated with Na-dikegulac (DK; 1000,2000 and 4000 µg/ml) on seed germination and field emergence capacity of the germinating seeds.

Seeds were presoaked with the test solutions or distilled water for 8h and then sundried. This was repeated three times in close succession and the seed lots were kept under 95% RH. Germination and field emergence capacity were recorded after a germination period of 5 and 10 days respectively.

Treatments (µg/ml)	Germination (%)				Field emergence (%)			
	Accelerated ageing (days)							
	10	20	30	40	10	20	30	40
* Check	*100	-	-	-	*85.6	-	-	-
+ Control	90.0	78.5	44.0	28.9	78.5	65.0	37.2	20.7
DK 1000	88.5	86.8	65.7	52.5	83.0	79.5	59.8	45.8
DK 2000	87.9	82.8	58.5	40.8	79.9	74.8	52.9	36.9
DK 4000	89.0	83.5	62.5	49.9	81.5	72.7	58.0	42.8
LSD (P=0.05)	#NS	3.92	4.50	5.05	3.56	4.10	4.38	2.87

*Check : Seeds not presoaked or given accelerated ageing treatment

+Control : Water-soaked seeds given acceelrated ageing treatment

#NS : Not significant

Table 10. Effect of accelerated ageing of sunflower seeds, pretreated with Na-dikegulac (DK; 1000, 2000 and 4000 µg/ml) on the speed of seed germination.

Treatments as in Table 9. Data on percentage seed germination were recorded at 24h intervals for 120h taking samples from seeds which underwent accelerated ageing for 0 and 30 days.

Treatments (µg/ml)	Days after accelerated ageing									
	0					30				
	Percentage germination after hours									
	24	48	72	96	120	24	48	72	96	120
+Control	26.6	56.0	84.9	100	100	0	4.0	20.1	32.9	44.0
DK 1000	21.0	33.9	59.3	85.4	100	3.0	22.5	32.1	48.7	65.7
DK 2000	14.0	34.0	54.6	79.9	96.7	3.0	26.4	38.3	50.0	60.5
DK 4000	12.5	29.9	50.8	70.0	92.0	2.9	25.0	36.4	49.8	62.5
LSD (P=0.005)	1.75	3.01	5.14	8.01	*NS	#NC	0.78	3.01	3.80	4.05

+Control : Water-soaked seeds given accelerated ageing treatment

*NS : Not significant

#NC : Not calculated

Table 11. Effect of accelerated ageing of sunflower seeds, pretreated with Na-dikegulac (DK; 1000, 2000 and 4000 µg/ml) on root length, shoot length and seedling dry weight.

Treatments as in Table 9. The data were recorded from 15-day-old seedlings, raised from the pretreated seeds.

Treatments (µg/ml)	Root length (cm)				Shoot length (cm)				Seedling dry wt. (mg)			
	Accelerated ageing (days)											
	10	20	30	40	10	20	30	40	10	20	30	40
*Check	*12.5	-	-	-	*12.8	-	-	-	*962	-	-	-
+Control	12.5	12.0	8.5	6.6	12.8	10.7	8.9	7.0	958	948	765	580
DK 1000	10.2	9.9	8.9	8.4	10.8	10.7	10.3	10.0	959	949	890	750
DK 2000	9.4	9.1	7.9	7.8	10.2	9.9	9.5	9.0	955	960	879	740
DK 4000	9.3	9.0	7.8	7.8	10.0	9.8	9.3	9.4	949	950	875	741
LSD(P=0.05)	0.95	0.78	0.56	0.40	1.00	0.85	0.67	0.65	#NS	#NS	39.8	34.5

*Check : Seeds not presoaked or given accelerated ageing treatment.

+Control : Water-soaked seeds given accelerated ageing treatment.

#NS : Not significant

Table 12. Effect of accelerated ageing of sunflower seeds, pretreated with Na-dikegulac (DK; 1000, 2000 and 4000 µg/ml) on DNA and RNA (µg/g wet weight) levels in cotyledons of the seed samples.

Treatments as in Table 9. The data were recorded at 10-day intervals.

Treatments (µg/ml)	DNA				RNA			
	Accelerated ageing (days)							
	10	20	30	40	10	20	30	40
* Check	*595	-	-	-	*1358	-	-	-
+ Control	520	415	360	282	1190	970	787	605
DK 1000	488	428	400	347	1250	1139	1041	902
DK 2000	452	395	370	340	1148	1050	960	828
DK 4000	448	412	382	345	1098	1038	952	825
LSD (P=0.05)	30.8	27.9	22.5	38.4	17.8	80.5	52.4	55.7

*Check : Seeds not presoaked or given accelerated ageing treatment

+Control : Water-soaked seeds given accelrated ageing treatment

Table 13. Effect of accelerated ageing of sunflower seeds, pretreated with Nadikegulac (DK; 1000,2000 and 4000 µg/ml) on soluble carbohydrate (mg/g wet weight) and amino acid (mg/g wet weight) levels in cotyledons of the seed samples.

Treatments as in Table 9. The data were recorded at 10-day intervals.

Treatments (µg/ml)	Soluble carbohydrate				Amino acid			
	Accelerated ageing (days)							
	10	20	30	40	10	20	30	40
* Check	*9.4	-	-	-	*2.94	-	-	-
+ Control	10.8	14.0	22.5	18.2	3.25	4.80	8.05	8.10
DK 1000	12.7	13.1	16.8	14.7	3.38	4.36	6.16	6.05
DK 2000	12.9	14.3	16.0	15.0	3.60	4.10	4.98	5.01
DK 4000	12.9	14.5	16.2	14.8	3.71	4.02	5.15	5.25
LSD (P=0.05)	1.05	#NS	2.06	1.42	#NS	0.40	0.49	0.55

*Check : Seeds not presoaked or given accelerated ageing treatment

+Control : Water-soaked seeds given accelrated ageing treatment

#NS : Not significant

Table 14. Effect of accelerated ageing of sunflower seeds, pretreated with Na-dikegulac (DK; 1000,2000 and 4000 µg/ml) on dehydrogenase (expressed as △OD /g/5ml) and amylase [expressed as (ΔOD x Tv)/(t x v)] activities in cotyledons of the seed samples.

Treatments as in Table 9. The data were recorded at 10-day intervals.

Treatments (µg/ml)	Dehydrogenase				Amylase			
	Accelerated ageing (days)							
	10	20	30	40	10	20	30	40
* Check	*0.70	-	-	-	*19.5	-	-	-
+ Control	0.63	0.52	0.28	0.20	24.8	29.0	38.0	21.5
DK 1000	0.68	0.61	0.55	0.39	25.1	28.1	31.3	31.2
DK 2000	0.66	0.63	0.55	0.41	27.0	29.0	33.0	30.8
DK 4000	0.69	0.65	0.59	0.42	28.1	29.8	34.5	31.5
LSD (P=0.05)	0.045	0.070	0.039	0.012	2.01	#NS	2.25	2.72

*Check : Seeds not presoaked or given accelerated ageing treatment

+Control : Water-soaked seeds given accelrated ageing treatment

#NS : Not significant

Table 15. Effect of accelerated ageing of sunflower seeds, pretreated with Na-dikegulac (DK; 1000,2000 and 4000 µg/ml) on the activities of catalase and protease enzymes [expressed as ($\triangle$OD x Tv)/(t x v)] in cotyledons of the seed samples.

Treatments as in Table 9. The data were recorded at 10-day intervals.

Treatments (µg/ml)	Catalase				Protease			
	Accelerated ageing (days)							
	10	20	30	40	10	20	30	40
* Check	*156	-	-	-	*40.0	-	-	-
+ Control	145.1	128.0	80.8	58.6	49.8	60.8	97.2	99.8
DK 1000	145.8	139.5	127.5	110.5	52.5	53.7	62.5	71.3
DK 2000	139.4	137.6	117.1	100.8	54.8	59.0	70.0	69.7
DK 4000	136.9	137.9	109.8	98.7	56.5	50.2	73.1	77.6
LSD (P=0.05)	#NS	9.80	8.90	8.75	4.50	5.85	6.02	6.18

*Check : Seeds not presoaked or given accelerated ageing treatment

+Control : Water-soaked seeds given accelerated ageing treatment

#NS : Not significant

Table 16. Effect of seed pretreatment with Na-dikegulac (DK; 1000, 2000 and 4000 µg/ml) followed by accelerated ageing treatment of the seeds on changes in plant height (cm) and stem circumference (cm) of a dwarf sunflower cultivar.

Treatments as in Table 9. Plants were raised from accelerated aged as well as nonaged seeds and data were recorded at seedling stage (X), preheading stage (Y) and head development stage (Z) which corespond to 14-, 28- and 42 days of plant age respectively.

Treatments (µg/ml)	Accelerated ageing (days)	Plant height			Stem circumference		
		Developmental stages					
		X	Y	Z	X	Y	Z
+Control	0	13.5	36.8	65.9	1.05	1.70	2.82
	30	8.9	22.7	35.0	0.65	1.01	1.96
DK 1000	0	13.3	34.9	67.7	1.10	1.75	2.90
	30	10.0	27.9	50.1	0.82	1.30	2.38
DK 2000	0	12.6	33.0	62.9	1.07	1.79	2.98
	30	9.3	28.8	47.5	0.78	1.35	2.42
DK 4000	0	12.2	31.9	61.8	1.07	1.80	2.95
	30	9.2	26.0	46.9	0.75	1.35	1.39
LSD(P=0.05)		0.80	2.42	4.15	0.11	0.13	1.70

+ Control : Water-soaked seeds given accelerated ageing treatment

Table 17. Effect of seed pretreatment with Na-dikegulac (DK; 1000, 2000 and 4000 µg/ml) followed by accelerated ageing treatment of the seeds on changes in leaf area (cm^2) and plant dry weight (g) of a dwarf sunflower cultivar.

Treatments as in Table 9. Plants were raised from accelerated aged as well as nonaged seeds and data were recorded at three developmetnal stages of the plant as mentioned in Table 16.

Treatments (µg/ml)	Accelerated ageing (days)	Leaf area			Plant dry weight		
		Developmental stages					
		X	Y	Z	X	Y	Z
+Control	0	55.8	308.5	580.9	0.98	6.95	20.5
	30	20.1	185.6	385.5	0.42	3.80	9.08
DK 1000	0	42.9	295.0	592.1	0.94	6.77	19.9
	30	33.8	226.7	478.7	0.63	4.85	14.0
DK 2000	0	38.9	280.8	568.5	0.89	6.70	19.8
	30	28.8	213.5	459.7	0.58	4.72	14.5
DK 4000	0	37.7	276.6	559.8	0.88	6.75	20.2
	30	28.0	205.9	448.9	0.61	4.75	13.9
LSD(P=0.05)		2.01	17.25	35.70	0.05	0.32	1.02

+ Control : Water-soaked seeds given accelerated ageing treatment

Table 18. Effect of seed pretreatment with Na-dikegulac (DK; 1000, 2000 and 4000 µg/ml) followed by accelerated ageing treatment of the seeds on changes in chlorophyll (mg/g fr. wt.) and protein (mg/g fr. wt.) contents in leaves of a dwarf sunflower cultivar.

Treatments as in Table 9. Plants were raised from accelerated aged as well as nonaged seeds and data were recorded at three developmental stages of the plant as mentioned in Table 16.

Treatments (µg/ml)	Accelerated ageing (days)	Chlorophyll			Protein		
		Developmental stages					
		X	Y	Z	X	Y	Z
+Control	0	1.39	1.70	2.10	34.5	45.0	54.2
	30	0.72	1.05	1.21	18.7	25.0	33.5
DK 1000	0	1.18	1.65	2.09	27.4	44.0	54.0
	30	0.88	1.34	1.68	22.0	33.0	44.8
DK 2000	0	1.18	1.60	2.05	27.0	40.0	52.8
	30	0.85	1.30	1.60	22.7	31.7	42.1
DK 4000	0	1.12	1.56	2.01	25.9	38.5	52.0
	30	0.83	1.32	1.52	20.2	32.1	43.5
LSD(P=0.05)		0.078	0.12	0.16	2.10	2.95	3.05

+ Control : Water-soaked seeds given accelerated ageing treatment

Table 19. Effect of seed pretreatment with Na-dikegulac (DK; 1000, 2000 and 4000 µg/ml) followed by accelerated ageing treatment of the seeds on changes in RNA (µg/g fr. wt.) and soluble carbohydrate (mg/g fr. wt.) contents in leaves of a dwarf sunflower cultivar.

Treatments as in Table 9. Plants were raised from accelerated aged as well as nonaged seeds and data were recorded at three developmental stages of the plant as mentioned in Table 16.

Treatments (µg/ml)	Accelerated ageing (days)	RNA			Sol. carbohydrate		
		Developmental stages					
		X	Y	Z	X	Y	Z
+Control	0	333	436	588	1.05	2.85	2.80
	30	245	288	372	0.79	2.08	1.92
DK 1000	0	310	419	582	0.99	2.77	2.75
	30	267	358	472	0.82	2.35	2.46
DK 2000	0	302	422	580	0.98	2.70	2.70
	30	261	349	467	0.82	2.21	2.48
DK 4000	0	295	427	585	1.05	2.66	2.70
	30	253	357	478	0.77	2.19	2.39
LSD(P=0.05)		22.7	27.2	40.8	0.08	0.15	0.17

+ Control : Water-soaked seeds given accelerated ageing treatment

Table 20. Effect of seed pretreatment with Na-dikegulac (DK; 1000, 2000 and 4000 µg/ml) followed by accelerated ageing treatment of the seeds on changes in the activities of catalase [expressed as (△OD x Tv)/(t x v)] and superoxide dismutase (expressed as △OD/g/10ml) enzymes in leaves of a dwarf sunflower cultivar.

Treatments as in Table 9. Plants were raised from accelerated aged as well as nonaged seeds and data were recorded at three developmental stages of the plant as mentioned in Table 16.

Treatments (µg/ml)	Accelerated ageing (days)	Catalase			Superoxide dismutase		
		Developmental stages					
		X	Y	Z	X	Y	Z
+Control	0	229	318	366	15.2	22.7	35.8
	30	157	201	237	7.9	14.0	20.7
DK 1000	0	207	300	364	12.7	18.8	36.0
	30	167	240	288	8.8	16.1	28.5
DK 2000	0	190	307	353	10.9	17.7	36.8
	30	163	245	277	7.9	16.5	27.2
DK 4000	0	188	305	349	11.2	17.5	33.2
	30	162	229	266	7.9	15.9	24.9
LSD(P=0.05)		18.0	22.5	24.7	0.78	1.20	2.00

+ Control : Water-soaked seeds given accelerated ageing treatment

Table 21. Effect of seed pretreatment with Na-dikegulac (DK; 1000, 2000 and 4000 µg/ml) followed by accelerated ageing treatment of the seeds on changes in the activities of IAA-oxidase and protease enzymes [both are expressed as (△OD x Tv)/ (t x v)] in leaves of a dwarf sunflower cultivar.

Treatments as in Table 9. Plants were raised from accelerated aged as well as nonaged seeds and data were recorded at three developmental stages of the plant as mentioned in Table 16.

Treatments (µg/ml)	Accelerated ageing (days)	IAA-oxidase			Protease		
		Developmental stages					
		X	Y	Z	X	Y	Z
+Control	0	12.0	22.5	26.8	35.5	70.3	88.8
	30	17.1	36.1	48.9	44.6	90.5	130.7
DK 1000	0	12.8	23.0	27.5	38.0	74.8	92.8
	30	16.7	30.2	36.5	43.0	82.2	103.6
DK 2000	0	13.0	23.2	28.0	38.3	74.5	95.0
	30	16.9	29.5	38.1	44.8	79.8	100.8
DK 4000	0	13.5	23.8	29.0	40.0	72.5	89.9
	30	16.9	28.9	35.7	43.9	77.5	106.5
LSD(P=0.05)		1.25	1.88	2.25	3.08	6.66	8.90

+ Control : Water-soaked seeds given accelerated ageing treatment

Table 22. Effect of seed pretreatment with Na-dikegulac (DK;1000, 2000 and 4000 µg/ml) followed by accelerated ageing treatment of seeds on the number of days required (after 0 h of seed soaking) for the inception of important stages in the life cycle of a dwarf sunflower cultivar.

Treatments as in Table 9. Plants were raised from accelerated aged as well as nonaged seeds and data were recorded at different stages like radicle emergence (A), leaf emergence (B), head initiation (C), ray floret opening (D), 50% floret opening (E), 100% floret opening (F), head yellowing (G) and harvest (H).

Treatments (µg/ml)	Accelerated ageing (days)	Days to attain stages							
		A	B	C	D	E	F	G	H
+Control	0	2.4	11.6	32.4	67.4	72.5	78.8	95.5	108.4
	30	5.5	14.3	38.2	73.8	80.9	89.7	107.2	123.6
DK 1000	0	2.7	11.8	33.0	67.0	73.0	80.0	96.1	110.0
	30	4.2	12.5	34.9	70.5	76.4	84.1	101.1	116.5
DK 2000	0	3.0	12.0	33.5	68.1	73.1	78.8	94.9	109.5
	30	4.1	12.6	36.0	70.0	75.8	83.5	99.5	115.4
DK 4000	0	3.2	12.1	33.5	66.7	72.5	79.0	94.3	107.9
	30	4.1	13.0	35.7	69.1	76.0	83.2	98.7	113.9
LSD(P=0.05)		0.25	1.02	2.01	2.50	3.01	3.52	4.92	5.64

+Control : Water-soaked seeds given acclerated ageing treatment

Table 23. Effect of seed pretreatment with Na-dikegulac (DK; 1000, 2000 and 4000 µg/ml) followed by accelerated ageing treatment of seeds on some yield attributes of a dwarf sunflower cultivar.

Treatments as in Table 9. Plants were raised from accelerated aged as well as nonaged seeds in the experimental field and data were recorded after harvest.

Treatments (µg/ml)	Accelerated ageing (days)	Yield attributes				
		Head diameter (cm)	Seed wt./ plant (g)	Filled seeds (%)	1000 seed wt.(g)	Seed oil (%)
+Control	0	16.8	28.9	57.2	58.0	38.5
	30	8.9	13.0	40.0	23.0	37.2
DK 1000	0	15.9	28.4	56.9	57.9	38.3
	30	12.0	18.5	49.0	35.7	37.5
DK 2000	0	16.0	28.8	56.2	57.7	38.4
	30	12.3	19.0	50.1	36.9	36.8
DK 4000	0	15.8	28.8	55.5	56.9	38.3
	30	11.7	18.7	49.6	34.8	36.9
LSD(P=0.05)		1.05	1.70	4.15	3.88	*NS

+Control : Water-soaked seeds given accelerated ageing treatment

*NS : Not significant

Table 24. Effect of seed pretreatment with Na-dikegulac (DK; 1000, 2000 and 4000 µg/ml) followed by accelerated ageing treatment of seeds and PEG-induced stress treatment for 48h on percentage germination and time (hours) to 50% germination (T50) of seeds of a dwarf sunflower cultivar.

Treatments as in table 9. After accelerated ageing seed lots were treated with PEG-6000 solution at –1.0 MPa for 48h. Data were recorded from stressed and nonstressed seeds after a germination period of 5 days.

Treatments (µg/ml)	Accelerated ageing (days)	Percentage germination		T50 of germination	
		Stressed	Nonstressed	Stressed	Nonstressed
+Control	0	48.5	100	67.8	45.5
	30	20.5	44.0	**	**
DK 1000	0	55.4	100	85.4	62.0
	30	42.7	65.7	128.0	98.5
DK 2000	0	58.0	96.7	89.5	66.1
	30	40.9	58.5	125.5	96.0
DK 4000	0	57.5	92.0	98.5	71.2
	30	41.2	62.5	127.0	96.8
LSD(P=0.05)		2.95	4.98	8.90	5.05

+Control : Water-soaked seeds given accelerated ageing treatment

** : Nonattainment of 50% germination

Table 25. Effect of seed pretreatment with Na-dikegulac (DK; 1000, 2000 and 4000 µg/ml) followed by accelerated ageing treatment of seeds and PEG-induced stress treatment of seedlings on the height (cm) and dry matter (g) content of seedlings of a dwarf sunflower cultivar.

Treatments as in table 9. After accelerated ageing seed lots were grown in Petri dishes containing sand and saw dust. Seven-day-old seedlings of each treatment were then subjected to water-stress by immersing the roots in PEG-6000 solution for 48h. Data were recorded from 15-day-old stressed and nonstressed seedlings.

Treatments (µg/ml)	Accelerated ageing (days)	Seedlings height (cm)		Seedling dry matter (g)	
		Stressed	Nonstressed	Stressed	Nonstressed
+Control	0	10.0	13.7	0.66	0.98
	30	6.4	9.0	0.32	0.44
DK 1000	0	11.5	13.5	0.75	0.97
	30	9.0	10.2	0.58	0.63
DK 2000	0	11.8	12.6	0.69	0.91
	30	8.9	9.4	0.54	0.60
DK 4000	0	11.7	12.3	0.70	0.90
	30	8.9	9.3	0.55	0.62
LSD(P=0.05)		0.55	0.89	0.42	0.48

+Control : Water-soaked seeds given accelerated ageing treatment

Table 26. Effect of seed pretreatment with Na-dikegulac (DK; 1000, 2000 and 4000 µg/ml) followed by accelerated ageing treatment of seeds and PEG-induced stress treatment of seedlings on chlorophyll (mg/g/fr.wt.) and protein (mg/g/fr.wt.) contents in leaves of seedlings of a dwarf sunflower cultivar.

Treatments as in table 9. Water-stress treatment and recording of data are the same as in Table 25.

Treatments (µg/ml)	Accelerated ageing (days)	Chlorophyll		Protein	
		Stressed	Nonstressed	Stressed	Nonstressed
+Control	0	0.70	1.40	22.5	35.8
	30	0.42	0.65	14.7	20.9
DK 1000	0	0.65	1.25	18.8	29.5
	30	0.55	0.75	16.5	24.8
DK 2000	0	0.63	1.23	20.0	28.0
	30	0.56	0.72	16.7	23.7
DK 4000	0	0.64	1.20	19.9	27.9
	30	0.53	0.66	16.7	23.5
LSD(P=0.05)		0.040	0.075	1.50	2.01

+Control : Water-soaked seeds given accelerated ageing treatment

Table 27. Effect of seed pretreatment with Na-dikegulac (DK; 1000, 2000 and 4000 µg/ml) followed by accelerated ageing treatment of seeds and PEG-induced stress treatment of seedlings on the activities of catalase [expressed as (△OD x Tv)/(t x v)] and superoxide dismutase (expressed as △ OD/g/10ml) enzymes in leaves of seedlings of a dwarf sunflower cultivar.

Treatments as in table 9. Water-stress treatment and recording of data are the same as in Table 25.

Treatments (µg/ml)	Accelerated ageing (days)	Catalase		Superoxide dismutase	
		Stressed	Nonstressed	Stressed	Nonstressed
+Control	0	185.0	236.0	10.2	15.8
	30	60.5	160.8	5.5	7.9
DK 1000	0	182.1	210.8	9.8	12.8
	30	82.9	177.5	7.6	8.9
DK 2000	0	169.9	193.5	10.0	11.1
	30	80.5	167.1	7.3	8.2
DK 4000	0	172.1	190.0	9.7	11.2
	30	80.5	169.8	7.3	8.0
LSD(P=0.05)		10.50	15.58	0.60	0.85

+Control : Water-soaked seeds given accelerated ageing treatment