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NOTES

EFFECT OF OSMOTIC PRIMING ON SEED GERMINATION AND VIGOUR OF NEEM (*AZADIRACHTA INDICA*)

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Neem (*Azadirachta indica* A.Juss), a native of the Indian sub-continent, is a useful species possessing aesthetic, insecticidal, medicinal, energy and timber values. It has about 44 alkaloids, of which the most important is azadirachtin, an active ingredient in its kernel oil. Rapid and uniform emergence of seedlings are two essential pre-requisities for increased yield and quality of a nursery. Rate and uniformity of emergence are dependent on seed quality and environmental conditions during seedling emergence. Slow emergence results in smaller seedlings (Ellis 1989), which are more vulnerable to soil-borne diseases (Osburn & Schroth 1989). In the last two decades, seed priming has become a common seed treatment to increase the rate and uniformity of emergence in many vegetable and flower crops. Several chemicals have been used for osmotic seed priming. Inorganic salts such as KNO_3 (Ells 1963) and K_3PO_4 (Cantliffe 1981), a chemically inert compound, polyethylene glycol 6000 (PEG 6000) (Bodsworth & Bewley 1981) and polyethylene glycol 8000 (PEG 8000) (Ali *et al.* 1990) are materials most commonly used to adjust osmotic potential. Osmotic priming with PEG is known to reduce germination time, synchronise germination, improve the germination percentage and seedling stand (Guedes *et al.* 1981). Against this backdrop, a study was conducted with different concentrations of PEG 6000 solution to evaluate their effect on seed germination, seedling length and vigour index.

Mature neem seeds were collected from a 25-y-old tree at the Forest College and Research Institute, Mettupalayam (11° 19' N, 76° 56' E, 300 m asl). The seeds were washed thoroughly in distilled water and soaked in PEG 6000 solutions of different concentrations, viz. 2.5, 5.0, 7.5, 10 and 12.5% each at five durations of 1, 2, 3, 4 and 5 days. Seeds soaked in water served as control. The soaked seeds were sown in raised nursery beds in a completely randomised design, replicated twice with 25 seeds each. Twenty-one days after sowing (ISTA 1993), the number of normal seedlings was counted and expressed as germination percentage. The root and shoot lengths (cm) were measured on 10 random one-month-old seedlings. To assess the dry matter production the respective parts of 10 random seedlings were kept in an oven maintained at 80 °C for 16 h. The vigour index was calculated as the integral of the germination percentage and seedling length (Abdul-Baki & Anderson 1973). The results were subjected to an analysis of variance and tested for significance ($p=0.05$) following Panse and Sukhatme (1967).

Different concentrations and durations of PEG soaking significantly affected the germination. Compared to water soaking, the concentrations 2.5, 5.0 and 7.5% gave improved germination by 15, 11 and 9% respectively (Table 1). Higher concentrations of 10.0 and 12.5% proved ineffective and were comparable to the control. The beneficial effect of the lower concentrations may be ascribed to the progressive rupture of the endosperm as was observed in lettuce seeds (Guedes *et al.* 1981). The different concentrations, however, had no bearing on either root length (Table 2) or shoot length (Table 3). Lack of influence of PEG on root length was also earlier reported in pepper (Stoffella *et al.* 1992). The trend of results relating to vigour index (Table 4) was similar to that on germination. Results on dry matter (Table 5) were inconsistent with overlapping parities. In parsley priming yielded 52% more shoot fresh weight than non-primed seeds 24 days after soaking (Pill 1986).

Soaking for 1,2 and 3 days proved superior to longer durations of 4 and 5 days for germination. Vigour index was maximum under 1 and 3 days durations. From a holistic perspective, soaking in 2.5% PEG for a duration of 1 day is advocated to maximise viability and vigour in neem.

Table 1. Effect of osmotic priming on germination (%) of neem seed

Duration	PEG concentration (%)						
(days)	2.5	5.0	7.5	10.0	12.5	Water	Mean
1	92	96	86	86	86	82	88
2	90	84	80	78	78	76	81
3	90	84	84	84	70	78	82
4	82	76	76	62	58	58	69
5	72	66	68	54	56	56	62
Mean	85	81	79	73	70	70	-
		Concentration (C)		Duration (D)		C × D	
SEd		3.9		3.5		8.7	
CD(p = 0.05)		7.9**		7.2**		ns	

SEd - standard error deviation; CD - critical difference.

Table 2. Effect of osmotic priming on root length (cm) of neem seedlings

Duration	PEG concentration (%)						
(days)	2.5	5.0	7.5	10.0	12.5	Water	Mean
1	9.0	10.9	9.0	9.5	9.7	9.0	9.5
2	8.5	8.6	10.7	9.5	8.8	8.7	9.1
3	8.9	10.5	8.8	9.1	9.1	9.0	9.2
4	11.3	9.7	9.1	7.7	9.2	9.7	9.4
5	10.3	9.6	9.8	10.6	10.2	10.9	10.2
Mean	9.6	9.8	9.4	9.3	9.4	9.4	
		C		D		C × D	
SEd		0.6		0.5		1.3	
CD(p = 0.05)		ns		ns		ns	

Table 3. Effect of osmotic priming on shoot length (cm) of neem seedlings

Duration (days)	PEG concentration (%) 2.5	5.0	7.5	10.0	12.5	Water	Mean
1	7.8	7.3	7.0	7.4	7.3	7.8	7.4
2	7.7	7.8	7.8	7.1	7.2	7.4	7.5
3	9.0	8.6	7.8	7.8	8.6	8.8	8.4
4	8.9	8.0	8.8	9.0	7.8	8.2	8.4
5	7.0	6.4	6.8	7.2	6.9	6.2	6.7
Mean	8.1	7.6	7.6	7.7	7.6	7.6	-

	C	D	C × D
SEd	0.3	0.3	0.6
CD(p = 0.05)	ns	ns	ns

Table 4. Effect of osmotic priming on vigour index of neem

Duration (days)	PEG concentration (%) 2.5	5.0	7.5	10.0	12.5	Water	Mean
1	1545	1732	1372	1457	1534	1372	1502
2	1393	1254	1399	1272	1223	1130	1278
3	1605	1610	1417	1420	1233	1381	1444
4	1643	1341	1350	1033	1005	1020	1232
5	1299	1138	1190	954	976	1019	1096
Mean	1497	1415	1345	1227	1194	1184	-

	C	D	C × D
SEd	88	80	197
CD(p = 0.05)	180**	164**	404**

Table 5. Effect of osmotic priming on dry matter (g 5 seedlings^{-1}) of neem seedlings

Duration (days)	PEG concentration (%) 2.5	5.0	7.5	10.0	12.5	Water	Mean
1	1.95	1.53	1.76	1.54	1.60	1.67	1.68
2	1.56	1.33	1.67	1.80	1.60	1.53	1.58
3	2.41	1.72	1.39	1.20	1.12	1.21	1.51
4	1.33	1.61	1.38	1.80	1.81	1.33	1.54
5	1.22	1.81	1.45	1.53	1.61	1.29	1.49
Mean	1.69	1.64	1.53	1.57	1.55	1.41	-

	C	D	C × D
SEd	0.02	0.02	0.04
CD(p = 0.05)	0.04**	0.03**	0.08**

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