Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5468

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (5):** 139-144 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Methods to Overcome Seed Dormancy in Linseed Genotypes

Kashinath Dandoti[1*], N. M. Shakuntala[1], Sangeetha Macha[1], S. N. Vasudevan[1] and Kisan[2]

[1]Department of Seed Science and Technology, University of Agricultural Sciences, Raichur- (Karnataka), India

[2]Department of Biotechnology, MARS, University of Agricultural Sciences, Raichur- (Karnataka), India

*Corresponding Author E-mail: kashinath.dandoti4@gmail.com

Received: 19.08.2017 | Revised: 30.08.2017 | Accepted: 31.08.2017

ABSTRACT

A lab experiment was conducted at the Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, Raichur to study the methods to overcome dormancy in linseed genotypes. Ten linseed genotypes were studied in the present investigation. Various physical and chemical treatments were imposed to break the dormancy of freshly harvested seeds. The KNO_3 treatment at 0.5 % showed significantly the highest mean germination (82.40 %), seedling vigour index (1549), seedling dry weight (43.7 mg), speed of germination (22.59), Among the genotypes, Suyog recorded maximum germination (75.14 %), seedling vigour index (1243), seedling dry weight (41.2 mg), speed of germination (19.97), Hence, KNO3 treatment at 0.5 % is effective for breaking dormancy in freshly harvested linseed genotypes.

Key words: *Dormancy, KNO_3, Linseed, Genotypes, Breaking methods*

INTRODUCTION

Linseed or flax (*Linum usitatissimum* L.) is an important crop of tropical as well as temperate zone of the world. If it is grown only for seed, it is called as oil flax, seed flax or linseed and when cultivated for fibre purpose, it is called fibre flax. Long stemmed linseed produces a high quality fibre and short stemmed linseed bears larger seeds of high oil content. The major linseed growing countries are India, Russia, Argentina, Canada, United States America, China, Egypt and Brazil *etc.* The total world linseed production is of 2.05mt with a productivity of 82.6 Kg ha^{-1} in an area of 24.85 m ha. While in India, it occupies an area of 296 thousand ha with a production of 1.55 lakh t and a productivity of 408 kg per ha. Rajasthan is the highest producer of linseed in India.Dormancy is problematic in agriculture as it affects plant establishment but it is the ability of the seeds to delay their germination until the time and place are right reflecting an important survival mechanism in plants. Another interesting physiological phenomenon observed in linseed is presence of dormancy from immediate harvest of crop up to 25-30 days depending on genotypes. Knowledge on the duration of seed dormancy is very much useful to seed analysts while testing seed samples.

Cite this article: Dandoti, K., Shakuntala, N.M, Macha, S., Vasudevan, S.N., and Kisan., Methods to overcome seed dormancy in linseed genotypes, *Int. J. Pure App. Biosci.* **5(5):** 139-144 (2017). doi: http://dx.doi.org/10.18782/2320-7051.5468

Dormancy is one mechanism by which seeds maintain their viability in unfavourable condition. In spite of this advantage, dormancy creates problem for seed analysts and seed producers, especially when germination percentage of seed lot must be determined in few weeks after harvesting.Knowledge on the seed dormancy breaking methods is very much useful to the farmers who take up seed production or crop production immediately after harvest. Eventhough dormancy breaking methods have been suggested in various crops. Present investigation was taken up with the objective of finding out various methods to break dormancy of linseed genotypes.

MATERIAL AND METHODS

The seed material used in the present study consisted of ten linseed genotypes with different duration of maturity obtained from Main Agricultural Research Station (MARS), University of Agricultural Sciences, Raichur, Karnataka, India.

Ten linseed genotypes were used they are as follows, Padmini, Suyog, Indira Alsi-32, Ruchi, T-397, Parvathi, NL-115, RLV-6, Shikha, S-36. Various physical and chemical dormancy breaking treatments viz., control, exposure to sun light for 48 hr, exposure to 45ºC for 24 hr and 48 hr, water soaking for 12 and 24 hr, soaking in KNO_3 at 0.5 and 1 per cent, soaking in HNO_3 at 0.5 and 1 per cent, soaking in ethrel at 25 and 50 ppm, hot water treatment at 50ºC and 60ºC for 1 min and soaking in Thiourea at 0.5 and 1 per cent were imposed to break the dormancy of freshly harvested seed. For the chemical treatments, soaking duration was 8 hr and the standard germination test was conducted thereafter.

The treated seeds were surface dried and tested for germination. Between paper methods of germination test as prescribed by the International Seed Testing Association was followed. Four replication of 100 seeds each were randomly counted and placed on the germination paper at uniform spacing of 25 mm between seeds in row. The rolled paper towels with seeds were secured at both the ends with rubber bands and placed vertically in cabinet of seed germinator by maintaining a constant temperature of 25±1°C and relative humidity of 90%. The germination was recorded on 7th day and based on normal seedlings produced the germination per cent was worked out. The seedling vigor index was determined by multiplying the percentage germination and total seedling length[1].

The data generated were statistically analyzed following completely randomized factorial design (CRFD) for laboratory studies; significance was tested by referring to 'F' table of Fisher and Yates[5].

RESULTS AND DISCUSSION

The KNO3 @ 0.5 % showed significantly the highest mean germination (82.40%) followed by sun drying at 48 hr (81.50 %), and water soaking for 24 hrs (81.00 %) while, control recorded the least germination of 59.33 per cent (Table 1). Among the genotypes, Suyog recorded maximum germination (75.14 %) and it was on par with Indira Alsi-32 (74.97 %) and Padmini (74.78 %), whereas minimum (70.64 %) was observed in S-36 followed by Shikha (72.61 %). The seeds treated with KNO3 @ 0.5 % recorded the highest mean seedling vigour index (1549), whereas lowest was in control (890). Among the genotypes, the highest mean seedling vigour index was recorded in Indira Alsi-32 (1286) and Padmini (1255) whereas lowest was observed in Shikha (1163) (Table 2).

The seeds treated with KNO3 @ 0.5 % recorded the highest mean seedling dry weight (43.7 mg), whereas lowest was in control (38 mg). Among the genotype the highest mean seedling dry weight was recorded in RLV-6 (41.8 mg) and Indira Alsi-32 (41.6 mg) whereas lowest was observed in S-36 and Padmini (41.1 mg) (Table 3). The seeds treated with KNO3 @ 0.5 % recorded the highest mean speed of germination (22.59), whereas lowest was in control (17.18). Among the genotypes, the highest mean speed of germination was recorded in Shikha (20.40) whereas lowest was observed in Padmini (19.65) (Table 4).

These results indicate that KNO_3 may be a more effective dormancy breaking agent for the genotype which perform longer dormancy duration. Similar results have been reported in *Rhynchosia capitata*[7], KNO_3 treated seeds break exogenous seed dormancy due to presence of a chemical inhibitor in the capsule and seed coat. KNO_3 may influence the formation of free radicals, which in turn improve vigour in Millets[2]. Increase in seedling vigour is due to increase in seedling length and dry weight. Recorded highest seedling vigour, dry matter accumulation and root length in soybean[9] seeds treated with nitrate.

KNO3 is well documented as a compound, which increases the germination of photo-dormant seeds in paddy[8]. KNO3 raises the ambient oxygen level available for citric acid cycle[3].

Table 1: Effect of dormancy breaking methods on germination (%) of linseed genotypes

Genotypes	Treatments												Mean
	Control	Sun drying (48 h)	Heat treatment (45 °C)		Water soaking	Hot water (1 min)		KNO_3		Ethel	Thiourea		
			24 h	48 h	24 h	50 °C	60 °C	0.5%	1%	25ppm	0.5%	1%	
Padmini	56.67	81.33	77.00	72.33	82.67	76.67	79.67	82.67	82.00	67.33	74.67	64.33	**74.78**
Suyog	57.00	83.67	75.33	75.00	81.00	76.33	80.33	82.67	76.67	68.67	73.33	71.67	**75.14**
Indira Alsi-32	64.33	82.33	79.00	74.33	80.33	81.00	83.00	83.67	74.67	64.67	66.67	65.67	**74.97**
Ruchi	58.67	78.00	75.00	75.33	80.67	74.33	76.33	81.67	75.00	65.33	74.67	64.33	**73.28**
T-597	64.67	82.67	75.67	75.67	83.00	74.00	76.00	84.33	75.33	66.00	65.67	63.33	**73.86**
Parvathi	56.67	81.33	76.00	77.67	83.00	73.67	76.00	84.67	80.33	63.00	66.00	64.00	**73.53**
NL-115	66.33	83.67	76.00	78.00	77.33	78.33	81.00	80.33	73.00	66.00	66.00	66.33	**74.36**
RLV-6	59.33	79.67	80.67	76.00	81.33	74.00	74.00	83.67	75.00	65.00	64.33	65.67	**73.22**
Shikha	56.33	83.33	75.33	76.00	84.00	74.00	72.00	81.00	75.67	64.67	62.00	67.00	**72.61**
S-36	55.33	79.00	74.67	71.00	76.67	67.67	68.67	79.33	73.00	66.00	67.67	68.67	**70.64**
Mean	**59.53**	**81.50**	**76.47**	**75.13**	**81.00**	**75.00**	**76.70**	**82.40**	**76.07**	**65.67**	**68.10**	**66.10**	

	S.Em±	CD at 1%
Genotype	0.48	1.38
Treatment	0.52	1.45
Interaction	1.65	4.60

Table 2: Effect of dormancy breaking methods on seedling vigour index of linseed genotypes

Genotypes	Treatments												Mean
	Control	Sun drying (48 h)	Heat treatment (45 °C)		Water soaking	Hot water (1 min)		KNO_3		Ethel	Thiourea		
			24h	48 h	24 h	50 °C	60 °C	0.5%	1%	25ppm	0.5%	1%	
Padmini	789	1448	1296	1094	1421	1350	1402	1662	1510	1055	1110	930	**1255**
Suyog	759	1467	1217	1159	1272	1322	1320	1595	1486	1093	1193	1041	**1243**
Indira Alsi-32	963	1672	1362	1198	1295	1345	1471	1702	1458	958	1052	962	**1286**
Ruchi	790	1374	1247	1210	1264	1285	1070	1569	1255	1058	1182	996	**1191**
T-597	957	1420	1271	1214	1556	1343	1115	1641	1356	1066	970	1068	**1248**
Parvathi	894	1304	1201	1197	1555	1384	1155	1553	1260	1019	992	1065	**1215**
NL-115	1107	1488	1205	1255	1349	1292	1232	1369	1260	1090	1050	977	**1223**
RLV-6	955	1391	1225	1193	1435	1212	1098	1444	1229	908	1055	1108	**1188**
Shikha	840	1347	1113	1211	1486	1112	1085	1460	1295	945	946	1117	**1163**
S-36	851	1352	1260	1117	1343	1175	1261	1496	1189	1006	1017	1191	**1188**
Mean	**890**	**1426**	**1239**	**1185**	**1397**	**1282**	**1221**	**1549**	**1330**	**1020**	**1057**	**1045**	

	S.Em±	CD at 1%
Genotype	0.48	1.38
Treatment	0.52	1.45
Interaction	1.65	4.60

Table 3: Effect of dormancy breaking methods on seedling dry weight (mg) of linseed genotypes

Genotypes	Treatments												Mean
	Control	Sun drying (48 h)	Heat treatment (45 °C)		Water soaking	Hot water (1 min)		KNO_3		Ethel	Thiourea		
			24 h	48 h	24 h	50 °C	60 °C	0.5%	1%	25 ppm	0.5%	1%	
Padmini	38.4	42.4	41.3	40.5	42.3	41.7	41.3	**44.9**	42.1	39.3	39.6	39.9	**41.14**
Suyog	37.9	43.6	41	41	42.5	41.9	41.4	44.3	42.7	39	40	39.4	**41.23**
Indira Alsi-32	37.6	42.8	41.8	41.4	43.2	42.3	42.2	42.8	43.3	39.7	40.6	41.3	**41.58**
Ruchi	37.3	42.2	41.6	41.2	42.4	42.2	42.1	44	42.3	41	41.1	41	**41.53**
T-597	38.8	42.4	41.7	41.3	42.5	41.8	41.8	43.3	41.2	41.4	41.4	40.2	**41.48**
Parvathi	38.8	43.4	41	41.1	42.3	41.7	41.4	43.7	41.1	40	41.7	41.6	**41.48**
NL-115	39.6	42.7	40.8	40.6	42.1	41.6	41.3	44.2	43.3	40.9	40	40.4	**41.46**
RLV-6	38.4	43.2	42.1	41.7	42.7	42.3	42.4	43.2	42.2	40.9	41.4	41.6	**41.84**
Shikha	37	42.3	41.4	41.6	43	41.7	41.8	44.1	42.4	40	39.7	39.6	**41.22**
S-36	37.8	43	41.9	41.3	41.5	41.4	41.2	42.8	42.4	40.3	40.5	39.4	**41.13**
Mean	**38.2**	**42.8**	**41.4**	**41.1**	**42.4**	**41.8**	**41.6**	**43.7**	**42.3**	**40.2**	**40.6**	**40.4**	

	S.Em±	CD at 1%
Genotype	0.48	1.38
Treatment	0.52	1.45
Interaction	1.65	4.60

Table 4: Effect of dormancy breaking methods on Speed of germination of linseed genotypes

Genotypes	Treatments												Mean
	Control	Sun drying (48 h)	Heat treatment (45 °C)		Water soaking	Hot water (1 min)		KNO_3		Ethel	Thiourea		
			24 h	48 h	24 h	50 °C	60 °C	0.5%	1%	25ppm	0.5%	1%	
Padmini	16.60	21.45	18.60	18.50	21.00	18.30	20.65	23.35	20.50	17.70	18.45	18.30	**19.65**
Suyog	16.95	22.45	18.75	18.55	22.10	18.70	20.85	22.40	20.85	17.85	19.10	18.70	**19.97**
Indira Alsi-32	17.40	22.00	19.35	19.00	21.85	18.20	21.75	22.45	21.50	18.55	17.70	18.20	**20.15**
Ruchi	17.15	21.05	19.05	18.30	20.95	17.75	21.25	22.50	20.70	18.35	18.25	17.75	**19.73**
T-597	17.45	22.10	19.40	18.85	21.75	18.40	20.00	22.60	19.95	19.10	18.60	18.40	**19.88**
Parvathi	17.00	21.65	19.00	18.10	21.80	18.70	20.25	22.10	20.35	18.25	19.15	18.70	**19.75**
NL-115	17.70	22.20	19.20	19.05	21.90	19.30	19.15	22.30	20.05	19.35	19.70	19.30	**20.03**
RLV-6	17.45	20.90	19.25	19.05	21.70	19.30	20.65	22.15	20.70	19.40	19.65	19.30	**20.03**
Shikha	16.75	22.20	19.35	20.10	21.35	20.20	20.70	23.25	20.80	18.95	20.15	20.20	**20.40**
S-36	17.30	21.05	19.45	18.65	21.50	19.60	19.40	22.75	19.75	19.65	20.50	19.60	**19.93**
Mean	**17.18**	**21.71**	**19.14**	**18.82**	**21.59**	**18.85**	**20.47**	**22.59**	**20.52**	**18.72**	**19.13**	**18.85**	

	S.Em±	CD at 1%
Genotype	0.48	1.38
Treatment	0.52	1.45
Interaction	1.65	4.60

Similar results were reported in *Panicum maximum*[11], in tropical grass[6]. KNO_3 may be helpful for reactivation of metabolic process of seeds. This compound may cause biosynthesis of auxin, which ultimately triggers the growth of embryo[10]. Nitrites promote seed germination by inhibition of H_2O_2 decomposition by catalase and help in the leakage of abscisic acid[4].

REFERENCES

1. Abdul-Baki, A. A. and Anderson, J. D., Vigour determination in soybean seed by multiple criteria. *Crop Sci.* **1:** 630-633 (1973).
2. Anil, studies on seed dormancy in foxtail and proso millet genotypes. M. Sc. (Agri.) Thesis, Univ. of Agric. Sci., Raichur, Karnataka, India (2015).
3. Bewley, J. D. and Black, M., Physiology and biochemistry of seeds. II. Development, germination and growth. Springer-Verlag Berlin Heidelberg, New York, USA (1972).
4. Cohn, M. A. and Castle, L., Dormancy in red rice IV. Response of unimbibed and imbibing seeds to nitrogen dioxide. *Physiologia Plantarum*, **60:** 552-556 (1984).
5. Fisher, R. A. and Yates, F.. Statistical tables for biological, agricultural and medical research. *Oliver and Boyd Co. Publ., London.* p.145 (1963).
6. Geetha, R., Studies on seed production, processing, dormancy and storage in blue buffel (*Cenchrus ciliaris*) cv. CO1. *Ph. D. Thesis, Tamil Nadu Agric. Univ., Coimbatore, Tamil Nadu (India)*(2001).
7. Hafiz, H. A., Asif, T., Muhammad, A. N. and Hafiz, N. AMethods to break seed dormancy of *Rhynchosia capitata*, a Summer annual weed. *Chilean. J. Agric. Res.* **71(3):** 483-488 (2011).
8. Hanumantappa, D., Vasudevan, S. N., Kisan, B., Wali, V. B., Anil, S. and Maruthi, K., Mechanism and duration of seed dormancy in paddy genotypes. *Envt. Ecology.*, **34(4)**: 2236-2240 (2016).

9. Kattimani, K. N., Reddy, Y. N. and Rajeswar Rao, B., Effect of presowing seed treatment on germination, seedling emergence, seedling vigour and root yield of Ashwagandha (*Withania sonmifera* D.). *Seed Sci. and Technol*., **27**: 483-488 (1988).
10. Khan, J., Rauf, M., Ali, Z., Rashid, H. and Khattack, M. S., Different stratification techniques on seed germination of Pistachio. *Pak. J. Biol. Sci.*, **2:** 1412-1414 (1999).
11. Previero, C. A., Martins, L., Fonseca, R. H. A. and Groth, D., 1996, Effect of storage of guinea grass *(Panicum maximum* Jacq.) on treatment to break dormancy. *Revista Brasileira de Semetes,* **18(1):** 143–148 (1998).