

Study on Botanical Treatment for Maintaining Longevity and Vigour during Ambient Storage

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ABSTRACT

An experiment was carried to find out the “Effect of deltamethrine and natural insecticides on seed quality parameter under ambient storage of lentil (*lens culinaris medic*) seeds” variety DPL-62 during 2012-13. The seeds were treated with eight insecticides in which seven were natural insecticides and one chemical treatment along with control. After maintaining seed moisture content of 10% the seeds were packed in cloth bag in three replications and stored for 10 months (July 2012 May 2013) under ambient condition at Seed Testing Lab., Department of Seed Science and Technology, C.S.A.U.A. & T., Kanpur.

For maintaining highest germination, vigour and field emergence of lentil variety DPL-62 seed treatment of chemical insecticide with two doses i.e. deltamethrine @ 0.04 ml/kg & 0.08 ml/kg seed were best but in place of deltamethrine, natural insecticide eucalyptus oil @ 10 ml/kg seed can also be used as it showed significantly similar performance to deltamethrine for maintaining germination (85.78%) and field emergence (78.01%) and stood on second place for dry weight of seedlings (0.247g), seed vigour index-I (1813.03) and seed vigour index-II (23.06) when stored for ten months in packaging of cloth bag under ambient conditions of Kanpur.

Key words: Seed vigour index, Seedlings, Post harvest losses, Pulses

INTRODUCTION

Post harvest losses in seeds are increasing year after year with increase production even after several technological advancement in the post harvest management of seed. We have not been able to lower down its losses due to insect and pest infestation during storage.

In India, where major portion of seed is stored in seed godown and they lack

scientific storage facilities. There are many factors associated with the loss of seed health and deterioration of quality. Such as abiotic and biotic factors include mites, nematodes, molds, fungi, insects or pests which affect the viability or vigour of seed during storage. The quality parameters of seeds deteriorate in number of ways in which infestation by insect or pest contributes a bulk share.

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The stored pulses are much damaged by pulse beetle or Bruchid (*Callosobruchus maculats*) in different part of the world. It is a major storage insect/pest which causing 30-55% loss in term of both quantities and quality constitutes.

Seeds of pulses are heavily damage by pulse beetle in storage and lentil is no exception. They feed on endosperm of seed leaving behind only seed coat. Thus seed losses its viability. *Callosobruchus chinensis* Linn, *Callosobruchus maculates* Feb. and *Callosobruchus analis* Feb. are most common species of pulse beetle found in India¹³.

Fumigation has been considered to be the most effective practical and quick method for controlling storage insect. There is need to manage the insect pest by using effective practices having less mammalian toxicity, long persistency and no adverse effect on seed quality parameters and more important ecofriendly. Lentil seed health can be maintained by applying the safe insecticides and plants products. Unlike insecticide and many plant products viz. castor oil, neem powder, mustard oil, eucalyptus oil, paradgoli, asafoetida and salt etc. by using optimum doses can control storage infestation effectively for longer period without hampering germination and vigour besides being cost effective, environmentally friendly less toxic and ecofriendly .

Use of chemicals is costly and may cause natural hazards, where botanicals are less costly, easily available to the farmers and safe to handle. Comparative study of botanicals along with one chemical insecticide can help to choose the suitable botanical for seed treatment of lentil for maintaining high viability and vigour. The studies were carried out to determine the best botanical treatment for maintaining longevity and vigour during ambient storage.

MATERIAL AND METHODS

The seeds were treated with eight insecticides in which seven were natural insecticides viz. eucalyptus oil, mustard oil, castor oil, dry neem powder, asafoetida, parad goli, salt and one chemical i.e. deltamethrine. Their doses were @ 0.04 and 0.08 ml of deltamethrine, 5 and 10 ml of eucalyptus oil, 5 and 10 ml of mustard oil, 5 and 10 ml of castor oil, 5 & 10 g of dry neem powder, 1 and 2g of asafoetida, 0.5 and 1g of parad goli and 5 and 10g of tata salt/kg seeds along with control (untreated).

After maintaining seed moisture content of 10% the seeds were packed in cloth bag in three replications and stored for ten months (July 2012 to May 2013) under ambient condition at Seed Testing Lab., Department of Seed Science and Technology, C.S.A.U.A. & T., Kanpur. The treated seeds and control were stored for 10 months i.e. July 2012 to May, 2013.

Observation Record:-

Bimonthly observations on germination and vigour were recorded from July 2012 to May 2013 on following parameters :-

GERMINATION TEST:- For germination test, three random samples of each treatment having hundred seeds each were taken. The seeds were kept between germination paper (B.P.) for germination. Samples were placed at 20⁰C and 90 to 95% relative humidity in germinator. On the ten days of putting normal seeding were recorded according to **ISTA rules 1985.**

SEEDLING LENGTH:- Three replications of each treatment were kept in between germination towel paper and sample placed in germinator at 20⁰C and 90.95% R.H. On the 10th days, samples were taken out from the germinator and randomly ten seedlings from each replication were removed and length was measured in cm.

DRY WEIGHT OF SEEDLING:- At final counting, randomly ten selected seedling were dried in hot air oven at 100⁰C temperature for 24 hours, then material was removed from the

oven and desiccated in desiccators for 2 hours and weighted in gram.

SEED VIGOUR INDEX I :-The seed vigour index was determined by multiplying the percent seed germination and total seedling length (cm) of all treatments separately in three replications.

SEED VIGOUR INDEX II :- Seed vigour index was determined by multiplying the percent seed germination and dry weight of seedling (g) of all treatments separately in three replications.

SEED MOISTURE CONTENT:- For moisture determination three replications each having 50g seeds of each treatment were grind is such way that at least 50 percent material should pass through a wire sieve with mesh of 4.0 mm. Samples were dried for one hour at 130°C in the oven. After drying, moisture percent was calculated by following formula.

FIELD EMERGENCE (IN SEASON) :-For this, 100 seeds in three replication of lentil were sown in the field in the month of November 2012. After 10 days of sowing emergence was recorded and expressed in %.

RESULT AND DISCUSSION

Seed have the best combinations of physical, chemical and genetic properties and will perform best to generate the new healthy crop provided the seeds have good quality and health and not heterogeneous in their physiological and genetic traits. This requires different check points at different levels of seed production, harvesting, processing and storage. In this study, we have taken check point during storage to maintain higher germination and vigour from harvesting to next planting season. Seed deterioration starts as we harvest the crop after physiological maturity. So, good storage conditions are essential for maintaining the longevity of seed because the rate of deterioration can only be slowed down by providing optimal storage conditions.

In spite of good storage conditions i.e. temperature and humidity, several other factors also deviate the seed longevity, vigour and seed health like moisture content of seed at the time of storage, packing, seed treatments, condition of storage godown. In India, where major portion of seed is stored is seed godown and they lack scientific storage facilities. There are many factors associated with the loss of seed health and deterioration of quality, such as abiotic factors are temperature, humidity, moisture oxygen availability and biotic factors include mites, nematodes, molds, fungi, insect or pest which affect the viability and vigour of seed during storage. The quality parameters of seeds deviate in number of ways in which infestation by insect or pest contributes a major role.

The stored pulses are much damaged by pulse beetle (or) Bruchid in different part of the world. It is a major storage insect/pest which causing (30-55%) loss in term of both quantities and quality constitutes. The beetle infestation occurs widely from the field itself and causing a significant loss in germination and other quality parameters. Seed of pulses are heavily damage by pulse beetle in storage and lentil is no exception. They feed on endosperm of seed leaving behind only seed coat. Thus seed losses its viability. *Callosobruchus chinensis* Linn., *Callosobruchus muculatus* Feb. and *Callosobruchus analis* Feb. are most common species of pulse beetle found in India¹³ (Raina 1970).

There is need to manage the insect pest by using effective practices having less mammalian toxicity, long persistency and no adverse effect on seed quality parameters and more important eco-friendly.

Lentil seed health can be maintained by applying the safe insecticides and plants products. Unlike chemical insecticide many plant products viz. castor oil^{7,10}, mustard oil^{3,5,7}, neem powder^{2,4,8,9,16,18}, neem oil^{14,17,19}

and various oil like soybean oil, sesame oil, olive oil and safflower oil⁵ were used to maintain the seed quality during storage. Various scientists also reported that insect infestation can also be controlled by using the asafetida¹⁵.

The use of deltamethrine^{1,6,11,12} has been applied effectively for controlling the insect infestation on pulses.

In present study, seeds of lentil variety DPL-62 were treated by deltamethrine and seven natural insecticides with two doses each to find out the most suitable botanical insecticides which can replace the chemical insecticide deltamethrine without hampering the seed quality parameters.

Influence of seed treatments (T) on seed quality parameters during ambient storage of lentil seeds.

Effect of seed treatment with deltamethrine and natural insecticides having two doses of each showed significant influenced on all quality parameters i.e. germination %, seedling length, dry weight of seedlings, seed vigour index I, seed vigour index II and seed moisture content (%) during ambient storage period of 10 months i.e. from July 2012 to May 2013.

Significantly highest germination (86.15%), seedling length (19.93 cm), dry weight of seedling (0.25gm), seed vigour index I (1871.01), seed vigour index II (23.44) and field emergence (81.34%), was recorded when seed treated with deltamethrine 0.08 ml/kg (T₂) with minimum % reduction after 10 months of storage i.e. 8.35, 8.15, 5.30, 6.56 and 8.64% for germination, seedling length, dry weight of seedlings seed vigour index- I and seed vigour index-II respectively^{6,11,18}. Natural insecticide eucalyptus oil @ 10 ml/kg (T₄) and Asafetida @ 2g/kg (T₁₂) also exhibited similar performance to chemical insecticides deltamethrine @ 0.08 ml/kg (T₂) for maintaining germination i.e. 85.78 and 85.15% and percent reduction over control was 5.75 and 6.44%, respectively^{15,18}.

As far as for field emergence only eucalyptus oil @ 10 ml/kg (T₄) showed significantly similar performance to deltamethrine @ 0.04 (T₁) and 0.08 ml/kg (T₂) having 82.34, 81.34 and 78.01% field emergence, respectively, in deltamethrine @ 0.04, 0.08 ml/kg and eucalyptus oil @ 10 ml/kg treated seeds.

For field emergence (in season) i.e. in month of November 2012, treated seeds of lentil with other natural insecticides like mustard oil @ 5 ml/kg (T₅), castor oil @ 5 ml/kg (T₇), castor oil @ 10 ml/kg (T₈) and salt @ 10 g/kg (T₁₆) were also similar to deltamethrine @ 0.08 ml/kg (T₂) and deltamethrine @ 0.04 ml/kg (T₁) and eucalyptus oil 10 ml/kg (T₄) with 78.69, 80.19, 81.34 and 78.35%, respectively, but not performing well in other quality parameter such as germination, seedling length, dry weight, seed vigour index-I and seed vigour index-II^{5,7} (Doharey *et al* 1988, Parashivmurthy *et al* 1994, Haque *et al* 2002 and Yadav *et al* 2005).

Few natural insecticides such as mustard oil ml/kg (T₅), castor oil @ 5 ml/kg (T₇), castor oil @ 10 ml/kg (T₈) and mustard oil @ 10 ml/kg (T₆) were not found effective to maintain germination during ambient storage of 10 months because they should significantly inferior performance than control. Similarly dry weight of seedling significantly reduced than control when seeds were treated with mustard oil @ 10 ml/kg (T₆), mustard oil 5ml/kg (T₅) and castor oil @ 5ml/kg (T₇).

From the above facts it is very much clear that mustard oil @ 5 ml/kg (T₅), mustard oil @ 10 ml/kg (T₆), Castor oil @ 5 ml/kg (T₇) and castor oil @ 10 ml/kg (T₈) showed deleterious impact on germination and dry weight of seedling and should not be used for maintaining longevity & vigour in lentil seeds during ambient storage of 10 months.

Table : 1a Effects of treatments(T) and months(M) of storage on seed quality parameters

Treatments	Germination	%Reduction After 10month of storage	Seedlinglength	%Reduction After 10month of storage	Seedling dry wt	%Reduction After 10month of storage	Seedvigour index I	%Reduction After 10month of storage
	Mean		Mean		Mean		Mean	
Control (T0)	83.02**(73.28)	8.78	18.13**	9.16	0.240**	9.0.	1655.82**	17.31
Deltamethrin@(T1)0.04ml	86.03(75.82)	5.48	19.55	2.05	0.249	5.68	1836.17**	8.30
Deltamethrin@0.08ml (T2)	86.15(75.90)	5.33	19.93	0.15	0.250	5.30	1871.01	6.56
Eucalyptus @5ml(T3)	84.98(74.86)	6.63	19.73	1.15	0.245	5.30	1834.05	8.41
Eucalyptus @10ml(T4)	85.78(75.44)	5.75	19.41	2.75	0.247	7.19	1813.03	9.46
Mustard oil@5ml(T5)	79.36(70.72)	12.81	19.52	2.20	0.239	6.43	1725.4	13.84
Mustard oil@10ml(T6)	78.54(69.66)	13.71	19.51	2.25	0.238	9.46	1705.37	14.83
Castor oil@5ml(T7)	79.29(70.23)	12.88	19.51	2.25	0.237	9.84	1719.33	14.13
Castor oil@10ml(T8)	78.91(69.94)	13.30	19.45	2.55	0.238	10.22	1704.38	14.73
Dry neem @5g(T9)	83.53(73.60)	8.22	19.42	2.70	0.241	9.84	1782.88	10.96
Dry neem@10g(T10)	83.77(73.79)	7.96	19.36	3.00	0.244	7.57	1781.00	11.06
Asafoetida@1g(T11)	83.11(73.25)	8.69	19.44	2.60	0.244	7.57	177.31	11.24
Asafoetida@2g(T12)	85.15(75.00)	6.44	19.36	3.00	0.245	7.19	1803.05	9.95
paradgoli @0.5g(T13)	82.69(72.93)	9.15	19.29	3.35	0.240	9.09	1757.56	12.23
Parad goli@1g(T14)	83.16(73.29)	8.63	19.34	3.10	0.244	7.57	1769.12	11.65
Salt @5g(T15)	84.52(74.43)	7.14	19.59	1.85	0.245	7.19	1814.09	9.40
Salt @10g(T16)	84.41(74.33)	7.26	19.52	2.20	0.247	6.43	1805.75	9.82
Initial	91.02		20.57		0.264		2002.48	

Table 1b: Effects of treatments(T) and months(M) of storage on seed quality parameters

Treatments	Seed vigour index II	% Reduction after 10 months of storage	Moisture content %	%Reduction after 10 months of storage	Field emergence
	MEAN		MEAN		MEAN
Control(T0)	21.93**	14.64	9.09(20.39**)	14.3	72.95(65.1*)
Deltamethrin(T1)@0.04ml	23.43	8.80	10.19(20.59)	12.6	82.53(72.5)
Deltamethrin(T2)@0.08ml	23.44	8.64	10.10(20.51)	13.3	81.34(71.5)
Eucalyptus(T3)@5ml	22.72	11.56	9.89(20.39)	15.1	77.96(68.8)
Eucalyptus(T4)@10ml	23.06	10.24	9.92(20.30)	14.9	78.01(68.9)
Mustard oil(T5)@5ml	21.03	18.14	9.92	14.9	78.69(69.46)
Mustard oi(T6)@10ml	20.81	19.00	9.93	14.8	75.04(66.70)
Castor oil(T7)@5ml	20.94	18.49	9.66	17.1	80.19(70.64)
Castor oil(T8)@10ml	20.91	18.61	9.71	16.7	81.34(71.5)
Dry neem(T19)@5g	22.08	14.05	10.00	14.2	77.21(68.38)
Dryneem(T10)@10	22.43	12.69	10.10	13.3	76.83(68.03)
Asafoetida(T11)@1g	22.27	13.31	9.91	15.0	73.97(65.9)
Asafoetida (T12)@2g	22.85	11.05	10.09	13.4	72.58(64.9)
Parad goli(T13)@0.5g	21.83	14.83	10.09	13.4	75.04(66.7)
Parad goli(T14)@1.0g	22.13	13.86	10.02	14.0	73.67(65.7)
Salt (T15)@5g	22.70	11.64	9.93	14.8	77.60(68.6)
Salt(T16) @10g	22.89	10.90	10.10	13.3	78.35(69.1)
Initial %	22.06		11.63		

SUMMARY & CONCLUSION

Data analysed statistically and effects of seed treatment (T), month of storage (M) and their interaction (T×M) were significant for all parameters (germination %, seedling length, dry weight of seedlings (g), seed vigour index-I, seed vigour index-II and seed moisture content %).

Highest germination (86.15%), seedling length (19.93 cm), seed vigour index-I (1871.01), moisture content (10.19) and field emergence (82.53) was recorded when seed were treated for deltamethrine @ 0.08 ml/kg and stored ambiently for 10 months in packaging of cloth bag whereas seed treated with deltamethrine @ 0.04 ml/kg also exhibited at par performance to deltamethrine @ 0.08 ml/kg for germination (86.15%), dry weight of seedlings (0.250g), seed vigour index-II (23.44), moisture content (10.10%) and field emergence (81.34%).

As far as the performance of natural insecticide eucalyptus oil @ 10 ml/kg and asafotida @ 2 g/kg showed at par performance to deltamethrine @ 0.08 ml/kg and deltamethrine @ 0.04 ml/kg for germination and field emergence with 85.78 & 85.15% and 78.01 & 72.58%, respectively.

Natural insecticides like mustard oil @ 5 ml/kg, castor oil @ 5 ml/kg, castor oil @ 10 ml/kg, and salt @ 10 g/kg also behaved similarly to good performance like deltamethrine @ 0.08 ml/kg, deltamethrine @ 0.04 ml/kg and eucalyptus oil @ 10 ml/kg for field emergence in season i.e. in November, 2012.

After deltamethrine @ 0.08 ml/kg and deltamethrine @ 0.04 ml/kg, treatment of asfoetida @ 1g/kg, @ eucalyptus oil @ 10 ml/kg stood on second rank for maintaining dry weight (0.0247g), seed vigour index-II (23.06), moisture (10.02%) with least reduction % after 10 months of ambient storage i.e. 6.43%, 10.34%, 10.24% and 14.04%, respectively.

Few natural insecticidal treatments exhibited harmful effect on seed germination because they showed significantly inferior performance than control (80.02%). These

were mustard oil @ 5 ml/kg, castor oil @ 5 ml/kg, eucalyptus oil @ 10 ml/kg and mustard oil @ 10 ml/kg.

All parameters those were studied in this experiment reduced as the storage period proceeded from 0 (July 2012) to 10 (May 2013) months under ambient storage conditions except seed moisture content. It was fluctuated according the presence of relative humidity and temperature in the environment.

It is concluded from the study that for maintaining of lentil seed quality parameters seed treated by chemical insecticide with two doses i.e. deltamethrine @ 0.04 ml/kg & 0.08 ml/kg were best but in place of deltamethrine, natural insecticide eucalyptus oil @ 10 ml/kg seed can also be used as it showed significantly similar performance for maintaining seed quality.

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