

Efficacy of Seed Dressing Fungicides and Bioagents on Seed Health and Yield of Groundnut *In vivo*

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Seed infecting fungi are important constraints for the groundnut crop prior harvesting to storage. Many improved varieties have been developed in several countries in recent years, many of them were found susceptible to diseases due to narrow genetic makeup. Many fungal pathogens attack on the seeds and hamper seed health. Seed treatment with different fungicides and bio-agents is only one superior option for farmer's point of view on the basis of prevention is better than cure. All the fungicides and bio agents were superior over control under field condition. Significantly highest seed germination, survival per cent and 1000 seed weight was observed in the treatment of Sixer 75 WP (2g/kg seed) i.e. 89.33, 87.33 per cent and 524.96g respectively while highest yield was observed in the treatment *Trichoderma viride* (1410.33kg/ha).

Key words: Fungicides, Bioagents, Groundnut, treatment.

Groundnut (*Arachis hypogea* L.) is commercially important oilseed crop grown in about 100 countries covering 26.4 million hectares with a total production of 36.1 million tones of nuts in shell. In India, Karnataka, Andhra Pradesh, Gujarat and Maharashtra are the leading states in production of groundnut. In Gujarat, total area under cultivation of groundnut is about 18, 83,900 hectares with the production of 26, 64, 300 M.T of seeds with average productivity of 1414 kg ha⁻¹. In Dang, groundnut occupies about 4700 ha area with a total production of 6600 M.T with average productivity of 1411 kg ha⁻¹ (Anon., 2014). Many of these agents are major constraints of groundnut production and reduce yields as well as quality of crop substantially. Its seeds and seedlings are highly susceptible to several pathogens.

Deterioration of groundnut seeds due to fungal activity is normally associated with the production of off-colours and flavours, rancidity, discolouration, effects on yield and quality of oil, loss of seed viability and formation of mycotoxins (Twiddy, 1994). Fungi like *Aspergillus niger* var. Tieghem, *A. flavus* Link ex Fries., *Alternaria dianthicola* var. Neerg, *Curvularia lunata* (Wakker)Boedijn, *C. pellescens* Boedijn, *Fusarium oxysporum* f. sp. Ciceris (Padwick), *F. equiseti* f. sp. Cubense, *Macrophomina phaseolina* (Tassi) Goid, *Rhizopus stolonifer* (Ehrnb.Fr.)Vuill, *Penicillium digitatum* (Pers.) Sacc. and *P. chrysogenum* Thom. causes discolouration, rotting, shrinking, seed necrosis, loss in germination capacity and toxification to groundnut (Chavan and Kakde, 2008). Microbial seed deterioration is one of the most serious biotic constraints to the quality production of groundnut seeds. Seed treatment with effective fungicides and bio agent can manage the seed borne pathogens and increase the seed germination as well as yield.

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Attempt was made to find out superior fungicides and bio-agents that are essential for establishing desired plant population, good plant growth and better yield.

MATERIAL AND METHODS

Different chemicals and bio-agents were evaluated as seed treatment under field condition to check their effect on seed germination, per cent

survival of plant and Yield (Kg/plot) For this healthy seeds of local groundnut variety at Waghai (Dang) and TAG-37 variety at Vyara (Tapi) were inoculated with the mixture of all isolated fungi by soaking the seeds into mixed spore suspension of six different isolated fungi (10^8 cfu/ml) and then treated with all respective chemicals and bioagents before sowing the seeds for measuring the efficacy of treatments along with control.

Experimental details

Location I			
A	Location	:	Hill Millet Research Station, Waghai
B	Agro climatic sub region	:	South Gujarat heavy rainfall zone
C	Variety	:	Local variety
D	Season	:	<i>Kharif</i>
E	Design	:	RBD
F	Spacing	:	45cm x 10cm
G	Replication	:	3
H	Treatments	:	10
I	Method	:	Slurry method/Dry seed treatment
J	Seed sown per plot	:	100
K	Size of plot	:	Gross plot : 2.25m x 2m= 4.5m ² Net plot: 1.35 x 1.6m ²
Location II			
A	Location	:	Regional Rice Research Station, Vyara
B	Agro climatic sub region	:	South Gujarat heavy rainfall zone
C	Variety	:	TAG 37
D	Season	:	<i>Kharif</i>
E	Design	:	RBD
F	Spacing	:	45cm x 10cm
G	Replication	:	3
H	Treatments	:	10
I	Method	:	Slurry method/Dry seed treatment
J	Seed sown per plot	:	100
K	Size of plot	:	Gross plot : 2.25m x 2m= 4.5m ² Net plot: 1.35 x 1.6m ²

Mass culturing of *Trichoderma viride*

Pure culture of *Trichoderma viride* Navsari isolate available in the Department of Plant Pathology, N M College of Agriculture, NAU, Navsari was used. It was mass cultured on PDA for one week at 25°C temperature and resulting fungal growth was harvested from Petri plates into sterilized distilled water so as to obtain 10^8 cfu/ml suspensions. This spore suspension was used for seed treatment.

Mass culturing of *Pseudomonas fluorescens*

For obtaining formulation of *Pseudomonas* the bacterial bio-agent was

inoculated in Kings B broth, incubated at $26 \pm 1^\circ\text{C}$ in a BOD incubator for 48 hrs. The supernatant was discarded. Then the pellets were suspended in sterilized distilled water so as to obtain the 10^8 cfu/ml.

Mass culture of *Bacillus subtilis*

For obtaining formulation of *Bacillus subtilis*, (Navsari isolate) the bacterial bio-agent was inoculated in King's B broth, incubated at $26 \pm 1^\circ\text{C}$ in a BOD incubator for 48 hrs., and centrifuged for 5 minutes. The supernatant were discarded. Then the pellets were suspended in sterile water so as to obtain the 10^8 cfu/ml.

RESULT AND DISCUSSION

Seed germination (%)

The results pertaining to germination of seeds under field condition at Waghai and Vyara revealed that all the fungicides and bio agents were superior over control (Table 2). The germination per cent at both the location was observed in the range of 72.67 to 90.00 per cent at Waghai and 73.67 to 88.67 at Vyara. Significantly highest seed germination was observed in the treatment of Sixer 75 WP at both the locations Waghai and Vyara *i.e.* 90.00 and 88.67 per cent respectively, which was at par with the *Trichoderma viride* (88.00 and 87.00%), *Pseudomonas fluorescens* (87.00 and 87.00%) and *Bacillus subtilis* (83.67 and 82.00%) respectively. The remaining treatments also showed significant effect on seed germination which ranged from 81.00 to 81.33 per cent at both the locations.

Pooled Analysis

Pooled data on seed germination of both the locations showed significant effect in all the treatments. Significantly, highest seed germination was observed in the treatment of Sixer 75 WP (89.33%) which was statistically at par with *T. viride* (87.66%) and *P. fluorescens* (87.00 %). Topsin M, Bavistin and Contaf plus recorded higher seed germination over control.

Survival per cent (30 DAS)

The results on survival per cent, 30 days after sowing under field condition at Waghai and Vyara presented in Table 2. The survival per cent at both the location was observed in the range of 71.33 to 89.67 per cent at Waghai and 72.00 to 86.67 per cent at Vyara. Significantly highest survival per cent was observed in the treatment of Sixer 75

WP at both the locations *i.e.* 89.67 and 86.67 per cent respectively, which was at par with the *Trichoderma viride*, *Pseudomonas fluorescens* and *Bacillus subtilis* *i.e.* 87.67, 86.67 and 83.33 per cent respectively at Waghai and 85.67, 84.67 and 81.67 per cent respectively at Vyara.

The remaining treatments also showed significant effect on per cent survival over control at both the locations. Topsin M, Bavistin, Emisan and Contaf plus; survival was 81.00, 80.67, 80.00 and 80.67 per cent at Waghai and 79.67, 79.33, 76.67 and 79.33 per cent at Vyara respectively.

Pooled

Pooled data on survival per cent of both the locations after 30 DAS showed significant effect in all the treatments. Significantly, highest survival (%) was observed in the treatment of Sixer 75 WP (88.16%) which was statistically at par with *T. viride* (86.66%) and *P. fluorescens* (85.66 %). Remaining treatments, Topsin M, Bavistin and Contaf plus recorded. 80.33, 80.67 and 80.00 per cent survival after 30 DAS respectively.

Survival per cent (45 DAS)

The results on survival per cent 45 days after sowing under field condition at Waghai and Vyara presented in Table 2. The survival per cent at both the location was observed in the range of 71.00 to 89.67 per cent at Waghai and 72.00 to 86.00 per cent at Vyara. Significantly highest survival per cent was observed in the treatment of Sixer 75 WP at both the locations *i.e.* 89.67 and 86.00 per cent respectively, which was at par with the *Trichoderma viride*, *Pseudomonas fluorescens* and *Bacillus subtilis* *i.e.* 87.33, 86.67 and 83.00 per cent respectively at Waghai and it was at par with all the treatments except control at Vyara.

Table 1. Details of seed treatment

S.No.	Trade Name	Technical name	Concentration in g or ml for kg and lit
1.	Topsin M 70% WP	Thio-phanate methyl	1g
2	Bavistin 50% WP	Carbendazim	2g
3	Emisan 6% WP	MEMC	3g
4	Thiram 75% WP	TMTD	3g
5	Contaf plus 5% EC	Hexaconazole	2ml
6	Sixer 75% WP	Carbendazim 12% + Mancozeb 63%	2g
7	NAU isolate	<i>Trichoderma viride</i>	6g
8	NAU isolate	<i>Pseudomonas fluorescens</i>	6ml
9	NAU isolate	<i>Bacillus subtilis</i>	6ml
10	Control	-	-

Table 2. Efficacy of seed dressing fungicides and bio agents on germination and survival of groundnut under field condition

S. No	Treatment	Seed germination (%)*		Pooled	Survival (%) 30 DAS*		Pooled	Survival (%) 45 DAS*		Pooled
		Waghai	Vyara		Waghai	Vyara		Waghai	Vyara	
1	Topsin M (1g/kg seed)	81.33	81.33	81.33	81.00	79.67	80.33	80.67	79.33	80.00
2	Bavistin (1g/kg seed)	81.33	80.67	81.00	80.67	79.33	80.00	80.67	79.00	79.83
3	Emisan 6% WP (3gm/kg seed)	80.33	78.00	79.16	80.00	76.67	78.33	79.67	78.33	79.00
4	Mancozeb 75% WP (2g/kg seed)	79.67	80.00	79.83	79.33	79.00	79.16	79.33	80.00	79.66
5	Contaf plus 5 % EC (2ml/kg seed)	81.33	81.00	81.16	80.67	79.33	80.00	80.00	79.00	79.50
6	Sixer 75 WP (2gm/kg seed)	90.00	88.67	89.33	89.67	86.67	88.16	89.67	86.00	87.83
7	<i>Trichoderma viride</i> (6g/kg seed)	88.33	87.00	87.66	87.67	85.67	86.66	87.33	84.67	86.00
8	<i>Pseudomonas fluorescens</i> (6ml/kg seed)	87.00	87.00	87.00	86.67	84.67	85.66	86.67	84.67	85.66
9	<i>Bacillus subtilis</i> (6ml/kg seed)	83.67	82.00	82.83	83.33	81.67	82.50	83.00	81.33	82.16
10	Control	72.67	73.67	73.16	71.33	72.00	71.66	71.00	72.00	71.50
	S. Em ± (T)	2.42	2.52	1.75	2.46	2.35	1.70	2.95	2.38	1.89
	T x L -	-	2.47	-	-	2.41	-	-	2.68	-
	C.D at 5% (T)	7.21	7.50	5.02	7.33	6.99	4.89	8.76	7.09	5.44
	T x L -	-	NS	-	-	NS	-	-	NS	-
	C.V % 5.09	5.34	5.21	5.21	5.06	5.14	6.25	5.14	5.73	5.73

* Average of three replications and 1000 seeds in each replication

The remaining treatments also showed significant effect on per cent survival over control at Waghai in Topsin M, Bavistin, Emisan and Contaf plus; survival was 80.67, 80.67, 79.67 and 80.00 per cent survival after 45 DAS respectively.

Pooled

Pooled data on survival per cent of both the locations after 45 DAS showed significant effect in all the treatments. Significantly, highest survival (%) was observed in the treatment of Sixer 75 WP (87.83%) which was statistically at par with *T. viride* (86.66%) and *P. fluorescens* (85.66 %). Topsin M, Bavistin and Contaf plus recorded 80.00, 79.83 and 79.50 per cent survival after 30 DAS respectively.

1000 seed weight (gm)

The result on 1000 seed weight (gm) at Waghai and Vyara presented in Table 3. The 1000 seed weight was observed in the range of 507.29 to 520.30 g at Waghai and 505.29 to 529.63 g at Vyara. Significantly highest 1000 seed weight was observed in the treatment of Sixer 75 WP at both the locations *i.e.* 520.30g and 529.63g respectively, which was at par with the *Trichoderma viride*, Mancozeb 75% WP, Contaf plus 5% EC and Emisan 6% WP *i.e.* 519.47, 519.13, 518.96, and 518.86 g respectively at Waghai. Similarly highest 1000 seed weight was observed in treatment of Sixer 75 WP

(529.63 g) which was at par with the treatment *Trichoderma viride* (527.47 g) at Vyara.

The remaining treatments also showed significant effect on 1000 seed weight over control at both the locations in Topsin M and Bavistin recorded 513.34 and 517.27 g respectively at Waghai and 515.01 and 521.60 g respectively at Vyara.

Pooled

The pooled data on 1000 seed weight at both the locations showed significant effect in all the treatments over control. Significantly highest 1000 seed weight was observed in the treatment of Sixer 75 WP (524.96 g) which was at par with *T. viride* (523.47g), Contaf plus 5% EC (521.79g), Mancozeb 75% WP (521.29g) and Emisan 6% WP (520.52g).

Seed yield (kg/ha)

The results on yield under field condition at Waghai and Vyara are presented in Table 3. The yield at Waghai was observed in the range of 900.00 to 1370.67kg/ha and 1056.67 to 1470.00 kg/ha at Vyara. Significantly highest yield at Waghai was observed in the treatment of *Trichoderma viride* (1370.67kg/ha) which was at par with all the remaining treatments except control. Similarly highest yield at Vyara was observed in the treatment of Sixer 75 WP (1470.00 kg/ha) which was at par with all the remaining treatments except control.

Table 3. Efficacy of seed dressing fungicides and bio agents on seed index and yield of groundnut under field condition

S. No.	Treatment	1000 seed weight (gm)		Pooled	Yield (kg/ha)		Pooled
		Waghai	Vyara		Waghai	Vyara	
1	Topsin M (1g/kg seed)	513.34	515.01	514.17	1205.00	1416.67	1310.83
2	Bavistin (1g/kg seed)	517.27	521.60	519.43	1220.67	1396.67	1308.67
3	Emisan 6% WP (3gm/kg seed)	518.86	522.19	520.52	1166.67	1403.33	1285.00
4	Mancozeb 75% WP (2g/kg seed)	519.13	523.46	521.29	1227.67	1423.33	1325.50
5	Contaf plus 5 % EC (2ml/kg seed)	518.96	524.62	521.79	1253.00	1456.67	1354.83
6	Sixer 75 WP (2gm/kg seed)	520.30	529.63	524.96	1336.67	1470.00	1403.33
7	<i>Trichoderma viride</i> (6g/kg seed)	519.47	527.47	523.47	1370.67	1450.00	1410.33
8	<i>Pseudomonas fluorescens</i> (6ml/kg seed)	517.03	520.36	518.69	1171.67	1389.00	1280.33
9	<i>Bacillus subtilis</i> (6ml/kg seed)	515.70	514.70	515.20	1267.00	1382.00	1324.50
10	Control	507.29	505.29	506.29	900.00	1056.67	978.33
	S. Em ± (T)	0.84	0.90	1.77	70.63	64.61	47.86
	T x L -	-	0.87	-	-	67.88	
	C.D at 5%	2.51	2.68	5.27	209.87	191.96	137.39
	T x L -	-	NS	-	-	NS	
	C.V %	0.28	0.30	0.29	10.10	8.08	9.03

*Average of three replications and 1000 seeds in each replication

Pooled

The pooled data on yield at both the location showed significant effect in all the treatments over control. Significantly highest yield was observed in the treatment *Trichoderma viride* (1410.33kg/ha) which was at par with all the remaining treatments except control.

In the present study fungicides such as Sixer 75 WP, Contaf plus 5% EC, Mancozeb 75% WP, Emisan 6% WP and Bavistin 50% WP as well as among the bio agents *T. viride* and *P. fluorescence* were found promising for improving seed germination, better survival of seedling, seed quality (1000 seed weight) and yield. Thus, seed treatment with Sixer 75 WP @ 2g/kg seed before sowing under field condition protect seed from mold infection and ultimately increase the yield. Efficacy of different fungicides and bio agents against seed borne fungi of groundnut has also been reported earlier. Dhedhi (2006), Bagwan (2011), Moradia (2011). Anbhule and Kareppa (2009) observed that presowing seed treatment with Sixer 75 WP (2g/kg) recorded minimum incidence of seed borne mycoflora. This results are in agreement with present investigation.

REFERENCES

1. Anbhule, K. A. and Kareppa, B. M., Effect of fungicides on seed germination and vigour index in groundnut. *International Journal of Plant Protection*. 2009; **2**(2): 291-291.
2. Anonymous., District wise area, production and yield per hectare of important food and non-food crop in Gujarat state. Publ. Directorate of Agriculture, Gujarat State Krishi Bhavan, Paldi, Ahmedabad, 2014.
3. Bagwan, Evaluation of biological potential of *Trichoderma* species against *Sclerotium rolfsii*, *Aspergillus niger* and *Aspergillus flavus*. *Internat. J. Plant. Protec.* 2011; **4**(1): 107-111.
4. Chavan, M. A. and Kakde, R. B., Aflarot a new disease of groundnut caused by *Aspergillus flavus*. *J. Agri. Sci.* 2008; **38**(3): 568.
5. Dhedhi, K. K., Dangaria, C. J., Parsana, G. J. and Joshi, A. K., Effect of presowing treatments for better crop establishment in summer groundnut. *Seed Research*. 2006; **34**(2): 168-172.
6. Moradia, A. M., Management of *Macrophomina phaseolina* in groundnut through systemic fungicides. *International Journal of Plant Protection*. 2011; **4**(1): 212-213.
7. Twiddy, C.M., Loss of viability in storage microflora. *Seed sci. and Technol.*, 1994; **1**: 547-562.