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EFFECT OF SOME FUNGI ON THE VIABILITY OF SOYBEAN SEED DURING STORAGE

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ABSTRACT

Role of 8 fungi at 3 levels of temperature and 4 levels each of relative humidity and storage time was studied with respect to viability of soybean seed during storage. In general higher per cent of seeds were viable at low temperature and relative humidity and short storage period. *Aspergillus flavus* and *A. niger* caused maximum drop in seed viability at temperature 8-10°C and 25±1°C and at all the 4 levels of RH (70-92%) while *A. nidulans* and *P. oxalicum* did the maximum at temperature 7.9-42.7°C. Drop in seed viability was increased due to all the treatments as the period of storage advanced.

KEY WORDS : Soyabean, Seed storage, Fungal infection

Fungi are known to cause deterioration of soyabean seed in storage (Dorworth and Christensen, 1968 and Dhingra *et al.*, 1973). However, only little is known so far about the cumulative effects of fungi and storage conditions. In the present investigation results of studies on the viability of soyabean seed during different storage conditions are reported.

MATERIALS AND METHODS

Effect of eight common fungi *viz. Aspergillus flavus, A. niger, A. nidulans, A. sydowi, A. terreus, Fusarium moniliforme, F. oxysporum, Penicillium oxalicum* and their mixture was studied by inoculating them on soybean seed and storing such seed at 3 levels of temperature *viz.* T_1 (10± 1°C in refrigerator), T_2 (25 ± 1°C in incubator), T_3 (20-30°C, RT), 4 levels of relative humidity (RH) *viz.* H_1 (70%, atmospheric humidity), H_2 (75%), H_3 (85%), H4 (92%) maintained by saturated salt solutions in desiccators at RT (25 ± 5°) and 4 levels of storing periods *viz.* P_1 (3 months), P_2 (6 months), P_3 (9 months) and P_4 (12 months) at RT (25 ± 5°C) following the procedure described by Papavizas and Christensen (1960) and Lange (1967).

Fresh and healthy seeds of soybean var. T49 were inoculated with 2 ml. fungal suspension (20 x 10^4 spore/ml)/10 g seed in Erlenmeyer flasks. Fungal suspension in each case was prepared by dissolving in 2-5 ml sterilized water, 1 g of culture filtrate from 2 week old culture. Uninoculated seedlots surface washed with similar quantity of sterilized water and untreated seedlots served as check 1 and 2 respectively. Treated seeds in each case were uniformly dried on sterilized blotting papers to remove excess moisture contents (Chalan *et al.*, 1967). One seedlot from each treatment having 300 seeds was stored as specified above. Stored seedlots were then examined for their viability at the expiry of 12 months for temperature and RH treatments and 3, 6, 9 and 12 months after storage for period treatments through germination test being run *in vitro* (25 ± 5°C) in petri dishes having sterilized sand (Anon., 1976). One hundred seeds/plate were placed and each set was replicated thrice. The readings were made by counting the germinating seeds and resulting juvenile seedlings. Data obtained are statistically analysed and compared.

RESULTS AND DISCUSSION

The effect of different temperature levels and associated fungi on seed viability was found variable. The highest germination count (g.c.) of 68.97 and 24.22 per cent was noted in seedlots inoculated with *P. oxalicum* and kept at temperature levels respectively T_1 and T_2, while at temperature level T_3 highest g.c. of 20.41 was found in seedlots treated with *F. oxysporum*. Similarly there was lowest g.c. of 62.52 and 17.51 per cent in seedlots inoculated with *A. flavus* at temperature levels respectively T_1 and T_2, but at temperature level T_3 the lowest of 11.54 per cent was found in seedlots inoculated with *P. oxalicum*. The g.c. in seedlots with other fungi fluctuated within the limits specified above. However, seedlots kept as check 1 (surface sterilized) and 2 (untreated) exhibited much higher g.c. of 73.33, 26.50, 22.97 and 70.70, 23.53, 20.34 per cent at temperature levels respectively T_1, T_2, and T_3 over other treatments.

Different RH levels and associated fungi also induced consequent decrease in g.c. with an increase in RH level. Maximum g.c. of 68.62, 47.31, 33.24 and 23.42 per cent was obtained in seedlots inoculated with *F.*

Table 1. Effect of different temperatures on germin ability of soybean seed var. T-49 in different treatments after 12 months of storage.

Treatments	Average percentage of germination		
	T_1 (8-10°C)	T_2 (25 ± 1°C)	T_3 (7.9-42.7°C)
Aspergillus flavus	62.52 (52.25)	17.51 (24.74)	13.27 (21.36)
Aspergillus niger	63.66 (52.93)	18.75 (25.66)	13.67 (21.70)
Fusarium moniliforme	63.87 (53.05)	22.55 (20.35)	19.90 (26.49)
F. oxysporum	64.95 (53.52)	21.84 (27.87)	20.41 (26.86)
Mixture of fungi	64.95 (53.70)	21.36 (27.52)	14.69 (22.54)
Aspergillus terreus	65.60 (54.69)	18.78 (25.68)	13.62 (21.66)
Aspergillus sydowi	65.66 (54.90)	18.20 (25.45)	13.40 (21.52)
Aspergillus nidulans	67.59 (55.30)	21.39 (27.55)	11.64 (19.95)
Penicillium oxalicum	68.97 (56.15)	24.22 (29.48)	11.54 (19.86)
Check II Unsterilized seeds)	70.70 (57.23)	23.53 (29.02)	20.34 (26.81)
Check I (Surface sterilized seeds)	73.33 (58.91)	26.50 (30.95)	22.97 (28.64)

The figures given in parentheses are the transformed values.

C.D. at 5% level

Treatments = 0.1984 Temperature = 0.1043 Treatments x Temperature = 0.3460

Table 2. Effect of different relative humidity on seed germinability of soybean seed var T.49 in different treatments after 12 months of storage.

Treatments	Average germination percentage			
	H_1	H_2	H_3	H_4
Aspergilus flavus	64.45 (53.40)	29.62 (32.97)	21.56 (27.67)	15.52 (23.20)
Aspergillus niger	65.57 (54.07)	32.42 (34.71)	23.37 (28.91)	14.40 (22.30)
Aspergillus terreus	66.31 (54.52)	37.92 (38.81)	23.22 (28.81)	15.27 (23.00)
Aspergillus nidulans	66.41 (54.58)	46.84 (43.19)	32.05 (34.48)	17.28 (24.56)
Penicillium oxalicum	66.54 (54.65)	31.09 (33.89)	28.62 (32.34)	16.52 (23.98)
Aspergillus sydoi	66.77 (54.80)	45.66 (42.51)	29.74 (33.05)	17.89 (25.02)
Fusarium oxysporum	67.35 (55.15)	37.46 (37.74)	23.77 (29.18)	15.39 (23.10)
Check II (unsterilized seeds)	67.59 (55.30)	48.44 (44.22)	32.47 (34.74)	23.42 (28.94)
Mixture of fungi	68.47 (55.84)	46.69 (43.10)	33.01 (35.07)	22.05 (28.01)
Fusarium moniliforme	68.62 (55.93)	47.31 (43.46)	33.24 (35.27)	23.42 (28.94)
Check I (Surface sterilized seeds)	68.75 (56.01)	49.28 (44.59)	33.99 (35.66)	24.47 (29.65)

Figures given in parentheses are the transformed values.

C.D. at 5% level

Treatments = 0.3550 Humidity = 0.2143 Treatments x Humidity = 0.7100

moniliforme and subjected to RH levels respectively H_1, H_2, H_3 and H_4 and lowest of 64.45, 29.62 and 21.56 per cent in seedlots inoculated with *A. flavus* and placed respectively at RH levels H_1, H_2 and H_3 while at RH level H_4 lowest was 14.40 per cent in seedlots treated with *A. niger.* There was comparatively higher g.c. in seedlots kept as checks 1 and 2 at all the RH levels.

Storing seed grains at RT reflected the decreasing trend in seed germination with the increasing time of storage. Highest g.c. of 72.59, 43.53, 28.44 and 22.62 per cent was found in seedlots inoculated with *A. sydowi* and stored respectively for 3, 6, 9 and 12 months. However, the lowest of 64.40, 30.69, 17.74 and 15.65 per cent was observed in seedlots inoculated with *A. flavus* and stored respectively for 3, 6, 9 and 12 months. Seedlots kept as checks (without fungi) exhibited higher g.c. compared to rest treatments.

The results reveal that the effect of temperature, RH and storing period on the deterioration of seed grains of soybean was significant and varied in case of different

Table 3. Effect of different storage periods on germinability of soybean seed var. T.49 in different treatments kept *In Vitro* (25° ± 5°C)

Treatments	Average germination percentage			
	P_1	P_2	P_3	P_4
Aspergillus flavus	63.40 (52.77)	30.69 (33.64)	17.74 (24.91)	15.65 (23.30)
Fusarium moniliforme	66.85 (54.85)	40.29 (39.40)	20.95 (27.24)	19.58 (26.26)
Aspergillus niger	67.36 (55.16)	35.10 (36.33)	22.11 (28.05)	15.75 (23.30)
Fusarium oxysporum	68.71 (53.99)	42.58 (48.73)	31.72 (34.28)	21.42 (27.58)
Mixture of fungi	69.54 (53.17)	37.79 (37.55)	23.37 (28.91)	16.47 (23.94)
Aspergillus terreus	70.54 (57.13)	34.55 (36.00)	24.22 (29.48)	18.55 (25.51)
Penicillium oxalicum	70.77 (57.27)	35.72 (36.70)	24.37 (29.58)	18.52 (25.49)
Check II (Unsterilized seeds)	71.40 (57.67)	50.54 (45.31)	19.97 (26.54)	18.55 (25.51)
Aspergillus nidulans	71.54 (57.76)	41.32 (40.00)	27.57 (31.67)	21.42 (27.57)
Aspergillus sydowi	72.59 (58.43)	43.53 (41.28)	28.44 (32.23)	22.62 (28.40)
Check I (Surface sterilized seeds)	74.65 (50.77)	68.49 (55.85)	45.94 (42.67)	32.38 (34.66)

The figures given in parentheses are transformed values.

C.D. at 5% level

Treatments = 0.458 Periods = 0.276 Period x Treatments = 0.916

fungi. *Aspergillus niger* and *A. sydowi* which were statistically at par, caused maximum drop in seed viability at low temperature (10 ± 1°C), while *P.oxalicum* and *A. nidulans* were more active and germicidal at RT (T_3). The rest of the fungi caused loss in seed viability within the limits specified above. The loss in seed viability was, however, minimum at all the temperature levels in seedlots kept without fungi (checks 1 and 2). Overall seedlots kept at low temperature (10 ± 1°C) suffered minimum loss in seed viability compared to that at temperature levels T_2 (25 ± 1°C) and T_3 (RT). Therefore, storing seed grains at low temperature is safer.

Studies on different RH levels have exhibited marked effect on seed viability. There was maximum drop in viability in seedlots kept at low RH (H_1 atmospheric humidity), followed by those kept at higher RH in case of all the treatments. *Aspergillus niger* caused the maximum loss in seed viability at all the 4 levels of RH followed by other fungi while *F. moniliforme* did the minimum. Seedlots without fungi suffered least

losses and thus proved the exclusive destructive role of fungi on seed viability.

Tests on storage period evidenced that as the storage time advanced the seed viability was decreased in case of all the treatments. However, the decrease in viability was minimum in seedlots inoculated with *A. sydowi* and maximum in those inoculated with *A. flavus*. These results are well in agreement with those of Greer (1953), Tarvet (1945), Kennedy (1964), Dorworth and Christensen (1968), Sanchez-Domingus *et al.* (1971) and Saharan and Gupta (1973) who had shown the deterioration in germinability of seeds due to associated fungi at different levels of temperature, RH and storing period. The seedlots treated with mixture of fungi instead of exhibiting additive effect, showed with mixture of fungi instead of exhibiting additive effect, showed lesser drop in seed viability compared to the individual fungal treatments perhaps due to their antagonistic effect.

In conclusion storage conditions viz. temperature,RH and time of storage though have their independent deteriorative effect on viability of soybean seed but association of different fungi at these levels further decreased the seed viability to the tune of 10.81 - 37.80 per cent. The germination percentage of soybean seed is reported to be usually poor which may probably be on account of the above factors and the associative role of above fungi. Thus it is advised to keep soybean seed free from fungi and stored at ideal conditions so as to avoid least possible damage to seed viability on this account.

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