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RESEARCH ARTICLE

Effect of botanicals on storability of sweet corn (*Zea mays* L. *Saccharum*) seeds

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ABSTRACT

An experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during *kharif 2008*, to find out to enhance storability of sweet corn seeds through use of botanicals treatment. The storage studies revealed that seeds treated with sweet flag rhizome powder @ 10 g per kg of seeds had recorded higher germination (87.3 %), dry weight of seedlings (2.01g), vigour index (2864) and less infestation (3.60 %) at the end of 10 months of storage.

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INTRODUCTION

Maize (*Zea mays* L.) is the world's third leading cereal crop after wheat and rice. It is one of the most widely grown cereals in the world and has great significance as human food, animal feed and raw material for large number of industrial products.

Sweet corn is an American crop. It cannot be regarded as a staple food but it is consumed fresh as confection. The cultivation of sweet corn almost dates back to the discovery of America by Columbus. Although records are meagre, there is good evidence that sweet corn was known and used by Indians of both North and South America.

Storage of seed till next sowing season is an essential part of seed industry. In general, cereals are most susceptible to storage pests and sweet corn is no exception. Because of its high protein content in sweet corn, seed is attacked by storage pests and other microflora. The rice weevil (*Sitophilus oryzae*) in storage causes considerable damage to the seed and deteriorates the quality of seed. Apart from this, fungi associated with stored seeds are chiefly responsible for deterioration of seed quality. In order to prevent the quantitative and qualitative losses due to storage pests and diseases. Several methods such as storage in safe conditions and containers with safe moisture levels and seed treatment with suitable chemicals or plant products etc. are being adopted.

An era of synthetic chemicals came with several insecticide and fungicide which successfully manage the infestation caused by insects, fungi and other microflora. But, the descriptive use of chemicals and their residual toxicity, adversely affect the non-target animals including human beings besides affecting the seed quality. Hence, the safe and feasible approach is the treatment of seeds with botanicals which are safe, eco-friendly, economical and easily available. It has been proved beyond doubt that, mixing of seeds with oils prevents the multiplication of beetles in cereals because of their repellent property and also smoothen the seed surface

so that beetle cannot proliferate on seed coat.

MATERIALS AND METHODS

The experiment was carried out under ambient conditions at the seed quality and research laboratory of National Seed Project (NSP), University of Agricultural Sciences, Dharwad during 2008-09. The sweet corn seeds (variety Madhuri) were treated with sweet flag rhizome powder 5g/kg of seed (T_1) and 10g/kg (T_2), Neem seed kernel extract powder 5g/ kg (T_3), Neem oil 5ml/kg (T_4), Nimbicidine 5ml/kg (T_5), Neem leaf powder 5g/kg (T_6), Deltamethrin 2.8 EC 0.5ml/ kg (T_7), Control (untreated seeds) (T_8). The experiment was laid out in Completely Randomized Design with four replication. Before imposing treatments, seed moisture content was brought to 11 per cent by sun drying. Two kg of seeds of each treatment were treated with plant products and chemical as per the treatments. The treated seeds were packed in cloth bag and stored along with untreated control under ambient storage for a period of 10 months.

The germination test was conducted as per ISTA (International Seed Testing Association) procedure (Anonymous, 1999), the seedling vigour index was calculated by multiplying germination (%) with seedling length (cm) as suggested by Abdul Baki and Anderson (1973). Insect infestation (%) was worked out by taking hundred seeds in four replications at random from each treatment. The extent of seeds damage due to *Sitophilus oryzae* (rice weevil) and *Rhizopertha dominica* (lesser grain borer) was observed closely with help of magnifying lens (100 X). The seed either with single or multiple holes were considered as infested seeds. The infested seeds were counted manually and the average was expressed in percentage of infestation. Dry weight of seedlings was measured by taking the ten normal seedlings used for root and shoot length. The seedlings were kept in blotter paper packet and dried in hot air oven maintained at 75^0C for 24 hrs. The dried seedlings were cooled in a dessicator for 60 minutes, then seedlings were weighed in an electronic balance and the weight was expressed in grams as dry weight of 10 seedlings.

RESULTS AND DISCUSSION

The data on seed quality parameters varied significantly throughout the storage period due to various treatments. The reduction in the germination of the seeds due to ageing and insect infestation up to 10 months of storage is presented in Table 1. At the end of storage period, significantly higher seed germination was recorded with seeds treated with sweet flag rhizome powder @ 10 g per kg seed (87.30 %) followed by sweet flag rhizome powder @ 5 g per kg seed (86.70 %) and the lowest in untreated seeds (78.00 %), significantly higher dry weight of seedling was observed in sweet flag rhizome powder @ 10 g per kg seed (2.01 g), followed by neem oil @ 5 ml per kg seed (1.76 g) and the lowest dry weight of seedling was recorded with untreated control (1.63 g), higher vigour index was noticed in sweet flag rhizome powder @ 10 g per kg seed (2864), which was on par with neem oil @ 5 ml / kg seeds (2598) and significantly lower vigour index was recorded in untreated control (2252) (Table 2).

After 10^{th} months of storage, significantly the lowest seed infestation was observed with the seeds treated with deltamethrin 2.8 EC @ 0.5 ml per kg seeds (3.06 %) followed by sweet flag rhizome powder @ 10 g per kg seed (3.60 %) and sweet flag rhizome powder @ 5 g per kg seeds (3.74 %). Significantly higher seed infestation was recorded with untreated seeds (24.84 %) (Table 2).

Seed storage is an integral part of seed production. During storage, considerable quantities of seeds are lost due to biotic and abiotic factors. In order to prevent quantitative

Table 1: Germination and dry weight of sweet corn seeds as influenced by different seed treatments during storage

Treatments	Germination (%)						Dry weight seedlings (g)					
	Storage period (months)											
	0	2	4	6	8	10	0	2	4	6	8	10
Sweet flag rhizome powder @ 5g/kg	94.3	93.3	91.7	88.3	87.7	86.7	2.63	2.39	2.23	2.16	2.06	1.73
Sweet flag rhizome powder @ 10g/kg	94.7	94.0	92.3	90.0	88.3	87.3	2.69	2.59	2.46	2.23	2.17	2.01
NSKE powder @ 5g/kg	94	90.3	88.0	86.7	82.3	80.0	2.48	2.01	1.75	1.71	1.66	1.67
Neem oil @ 5ml/kg	93.7	92.7	89.0	88.0	84.0	83.3	2.60	2.33	2.01	1.90	1.87	1.76
Nimbicidine @ 5ml/kg seed	93.7	93.0	90.7	87.7	86.7	81.7	2.43	2.07	1.86	1.79	1.79	1.66
Neem leaf powder @5g/kg	94	91.7	88.3	86.3	82.0	78.3	2.57	1.87	1.77	1.78	1.68	1.67
Deltamethrin 2.8 EC @ 0.5ml/kg	94.3	93.3	90.0	87.7	84.7	80.0	2.53	2.26	1.80	1.77	1.75	1.71
Untreated	93.7	89.0	87.0	84.3	81.3	78.0	2.63	1.79	1.71	1.70	1.66	1.63
Mean	94.1	91.9	89.4	87	84.3	81.6	2.57	2.19	1.94	1.88	1.53	1.72
S.E. (±)	2.4	0.5	0.7	0.7	0.5	0.6	0.08	0.07	0.07	0.08	0.06	0.06
C.D. (5%)	NS	1.4	2.0	2.1	1.4	1.8	NS	0.22	0.23	0.24	0.18	0.19

and qualitative losses in storage, various prophylactic measures are being adopted to reduce the losses *i.e.* by treating seeds with suitable pesticides, or with botanicals.

Irrespective of treatments, seed quality parameters declined progressively with increase in storage period. The average germination percentage, dry weight of seedlings and vigour index at the beginning of storage period were 94.10 per cent, 2.57 g and 3556, respectively, which declined to 81.6 per cent, 1.72 g and 2451, respectively at the end of 10th month of storage. This gradual decline in the quality of seeds during storage may be due to ageing effects, leading to depletion of food reserves apart from death of seeds because of insect infestation and fungal invasion. These results are in confirmation with Paneru *et al.* (1993) in wheat and Biradarpatil and Malabasari (2011) in maize.

Among the various treatments adopted sweet flag rhizome powder, neem oil, nimbicidine, deltamethrin, neem seed kernel extract powder and neem leaf powder were found to be superior in maintaining seed quality throughout the storage period over control. The seeds treated with sweet flag rhizome powder @ 10 g per kg of seeds recorded significantly higher seed quality parameters followed by other botanicals and deltamethrin as compared to control. From second month onwards till the end of storage the seeds treated with sweet flag rhizome powder @ 10 g per kg seeds (T_2) was recorded significantly higher values for germination (Table.1), dry weight of seedlings, seedling vigour index and lower values for seed infestation indicating superiority of these organics over control in maintaining the seed quality in storage.

During 10th month of storage seed germination recorded in T_2, T_1, T_4 and T_5 were 87.30, 86.70, 83.30 and 81.70 per cent, respectively whereas untreated control (T_8) recorded 78.00 per cent germination. This indicates that along with sweet flag rhizome powder, neem oil and nimbicidine were also helpful in maintaining the seed quality. The rate of reduction in germination percentage from beginning to the end of storage period was slower in the seeds treated with sweet flag rhizome powder @ 10g per kg (7.40 %), sweet flag rhizome powder @ 5g per kg (7.60 %) and neem oil (10.40 %) whereas, it was 15.70 per cent with untreated control. These results are in accordance with the findings of Deshpande (2004) in blackgram and Singh *et al.* (2006) in pigeonpea.

The better seed quality parameters was observed with chemicals and botanical treatments may be due to lower insect infestation noticed with these treatments.

The insects not only eat the food reserves in the seed, but also eat the germ, leading to death of the seed and hence result in poor seed germination.

The other quality parameters namely vigour index and dry weight of seedling at the end of ten month of storage with sweet flag rhizome powder @ 10g per kg was 2864 and 2.01 g, respectively, whereas untreated control recorded 2252, 1.63 g, respectively at the end of storage period. The other botanicals *viz.,* neem oil and neem seed kernel extract powder also recorded higher vigour index and seedling dry weight over untreated control. These results are in conformity with the reports of Merwade (2000), Kumbar (1999) in chickpea.

The superiority of nimbicidine and neem oil and deltamethrin was due to the fact that, these treatments keep the seeds intact as they binding material and cover the minor cracks and aberrations on the seed coat at initial stage thus blocking the fungal invasion. Apart from this, the insecticidal property present in these botanicals also helped the seeds incompatible for insects attack during storage (Prakash and Jagadishwari Rao, 1992). Further, the botanicals might also have the phytotonic effect resulting higher seed quality parameters. Similar beneficial effect of sweet flag rhizome powder in protecting the seeds from attack of *Rhizopertha dominica* (lesser grain borer) and *Sitophilus oryzae* (rice weevil) throughout the storage period next to seed treatment

Table 2: Vigour index and seed infestation of sweet corn seeds as influenced by different seed treatments during storage

Treatments	Vigour index						Seed infestation (%)					
	Storage period(months)											
	0	2	4	6	8	10	0	2	4	6	8	10
Sweet flag rhizome powder @ 5g/kg	3600	3503	3397	3233	3058	2555	0.00	0.33	0.68	1.70	3.06	3.74
Sweet flag rhizome powder @ 10g/kg	3629	3599	3382	3514	3084	2864	0.00	0.33	0.33	1.35	2.72	3.60
NSKE powder @ 5g/kg	3492	2832	2733	2548	2341	2265	0.00	0.33	4.41	8.49	14.28	21.75
Neem oil @ 5ml/kg	3493	3267	3100	3009	2775	2598	0.00	0.68	2.37	4.76	8.49	11.90
Nimbicidine @ 5ml/kg seed	3578	3395	3202	3041	2792	2565	0.00	0.33	0.68	2.72	4.76	8.84
Neem leaf powder @5g/kg	3504	3055	2812	2541	2397	2307	0.00	2.72	6.80	11.22	18.69	24.48
Deltamethrin 2.8 EC @ 0.5ml/kg	3585	3324	3074	3030	2611	2395	0.00	0.00	0.33	1.35	2.72	3.06
Untreated	3569	2697	2645	2652	2391	2252	0.00	4.41	9.18	18.02	20.73	24.84
Mean	3556	3233	3039	2573	2698	2451	0.00	1.14	3.48	6.20	9.39	12.50
S.E. (±)	93	91	92	95	93	96	NA	NA	0.51	0.69	0.79	0.50
C.D. (5%)	NS	273	278	286	279	289	NA	NA	1.54	2.06	2.37	1.50

with deltamethrin was observed in wheat by Biradar (2000) and Channabasanagouda (2008).

The stored seeds need to be protected from the insect attack for maintaining the high seed quality. To protect seeds from storage pests it is recommended to go for seed treatment with insecticides. As the insecticides are not safe to handle and hazardous to human health, it is better to find out suitable seed treating organics to protect the seeds from insects. In the present study, the seeds treated with organics namely sweet flag rhizome powder, nimbicidine and neem oil also recorded lower seed infestation percentage at par with deltamethrin (3.06 %) indicating the possibility of use of these botanicals in controlling the insect infestation in storage. Infestation observed in these treatments at 10th month of storage was 3.60, 3.74, 8.64 and 11.90 per cent, respectively (Table 2). Similar beneficial effect of botanicals in controlling insect attack during storage has been observed by Maraddi (2002) in cowpea and Umrao and Verma (2002) in pea seeds. Further, the main advantage of treating seeds with botanicals over chemicals is that, the seeds treated with botanicals if left can be reused for consumption purpose after washing with water. Whereas, it could not be possible in the seeds treated with the chemicals which has residual toxic effect on the human beings and animals.

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