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COMPARISON OF NEEM PRODUCTS WITH ACTELLIC AND DITHANE AS SEED DRESSERS ON THE VIABILITY AND VIGOUR OF STORED SEED MAIZE

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ABSTRACT

Samples of seed maize were treated with neem seed powder, neem leaf powaer and neem seed oil at 0.5% and 1.0% concentration each. Some of the seeds were also treated with Actellic 25 EC. and Dithane M45 (at the same levels of concentration as used for the neem products) while others were left untreated. The seeds were then stored for nine months in pre-sterilized black polythene bags. After the storage period, germination tests were performed on the treated seeds and the control to determine their viability. Vigour index and coefficient of velocity were also determined for each treated seed as a measure of seed vigour. Results showed that neem seed powder, neem seed oil and Actellic depressed the viability and vigour of seed maize. However, Dithane and neem leaf powder had no adverse effect on the quality of seed maize. Therefore, neem leaf powder could be used as seed dresser at 1.0% (W/W) concentration

Keywords: Neem, Viability, Vigour, Seed maize.

INTRODUCTION

The major problems farmers encounter in the storage of seeds are attack by seed-borne fungi and the storage insects (1). In order to prevent the pest and fungi attack, farmers are normally advised to treat their seeds with recommended fungicides and insecticides (2,3). Consequently, the treatment of seeds with synthetic fungicides and insecticides to control seed-borne pathogens and pest both in store and in the field has become a common practice. However, due to the high cost of synthetic pesticides and the increased environmental problems when misused, suggest that there should be alternatives which could be cheap, safe, locally available and biodegradable.

The neem plant is gradually becoming popular all over the world because it has been identified as an alternative to synthetic pesticide (4,5). Neem products are known to control some storage insects (6,7) and fungal growth on treated strored seeds (8). In developing countries like Ghana, using neem products as seed protectants against insect pests and storage fungi has become very imperative since the neem products are cheap, abundant locally and biodegradable. However, not much work has been done to find their effects on the viability and vigour of stored seed. This paper gives a report on experiments performed to study the effects of neem leaf, neem seed oil and neem seed powder in comparison with Actellic 25 EC and Dithane M45 on the viability and vigour of stored seed maize.

MATERIALS AND METHODS

Preparation of Neem Leaf And Seed Powder

Neem leaves were oven dried at a temperature of 60° C for twenty-four hours. The pulp of the fruit was removed by washing and the seeds dried under shade at room condition for one week at a temperature of 32° C ±2 and relative humidity ranging between 56 and 60%. The powder of both the leaves and seeds of neem was prepared by milling 300 g each of the dried seeds and leaves, separately, in a milling machine and the powder was then sieved through a fine size (0.003 mm in diameter) mesh before using.

Extration of Oil From Neem Seed.

Ripe neem fruits were collected from a neem tree. The pulp was washed off and seeds dried under shade (32° C - 34° C; 56-60% R.H.) for fourteen days. The hot water floatation method as suggested by Southwell and Harris (9), was used for oil extraction from the kernels. The seed coats were first removed to get kernels which were then roasted in clay pot over a coalpot for 30 minutes. They were then milled in a milling machine to obtain the flour which was suspended in distilled water and boiled up to one hour thirty minutes. After boiling, cold water was added to bring the supernatant oil to the surface and this was skimmed into a beaker.

Experimental Procedure

Seed maize, cultivar Abeleehi, obtained from Crop Research Institute, was multiplied in the field following the guidelines given for growing seed maize (3). Samples of the seed maize, with an initial moisture content of 11.5% and 98% germination, were surface-sterilized by washing in 1% sodium hypochlorite solution followed by 40% ethanol for one minute as suggested by Armolik et al. (10). Disinfected seeds were dried in a forced-air oven at 35° C for forty minutes.

One hundred grams (100 g) of seed maize samples were mixed with 0.5 and 1.0 ml. of neem seed oil, on a volume by weight basis to obtain final concentrations of 0.5 and 1.0% (V/W), respectively, in 250 ml conical flasks. The flasks were shaken by hand for twenty minutes at the rate of about fifty strokes per minutes to give uniform distribution of the oil on the seeds. A similar procedure was repeated for each of the treatments (ie Neem seed powder, Neem leaf powder, Dithane M45 and Actellic 25 EC). The concentrations of the powders were achieved by mixing 0.5 g and 1.0 g with 100 g of maize seeds, on weight by weight basis to obtain a final concentrations of 0.5 and 1.0% (W/W). Untreated seeds served as control. The treated seeds were stored separately in the laboratory in sterilized black polythene bags which were heat sealed. Each treatment was replicated four times and arranged in completely randomized design for storage. The temperature and the relative humidity of the laboratory ranged between 28.1 - 34.4° C and 49-90%, respectively, during the nine months storage period.

Assessment of the viability and vigour of seed

After the storage period, germination tests were carried out using the treated seeds, in four replicates of hundred seeds, sown in plastic bowls filled with pre-steam sterilized river sand. The bowls were 20 cm in diameter and had a depth of 9 cm. Twenty five seeds were sown in each bowl at the depth of about 3 cm and raised in the demonstration room of the Department of Horticulture, UST, Kumasi with a daily mean temperature of 27° C - 33° C and relative humidity of 56-80%,. The time of emergence and the number of germinated seeds as well as the root and shoot lengths of seedlings were recorded at the end of the seventh day. The following calculations were subsequently done to determine the vigour of each treated seeds:

Vigour Index (%) = (Shoot length + Root length) times % germination (7)

$$\text{Coefficient of velocity (\%)} = \frac{N_1 + N_2 + \ldots\ldots Nn}{D_1N_1 + D_2N_2 + \text{-----}DnNn} \times 100$$

N_1 is the number of seedlings emerged (counted)
D_1 is the number of days after planting corresponding to N_1
N_2 is the number of new seedlings emerged or counted
D_2 is the number of days after planting on which emerged N_2 was counted (11).

All data collected were subjected to analysis of variance and Duncan's Multiple Range Test was used to separate the means. Percentage values were transformed using arc sine transformation before the analysis.

RESULTS AND DISCUSSION

Effect on Germination

The data for the mean germination percentage of the treatments are presented in Table 1. Seeds treated with Dithane M45 (0.5%) had the highest germination value of 96.4% where as seed treated with Actellic 25 EC (1.0%) had the lowest value of 25.0%. Seeds treated with Dithane M45 (at 0.5%) had significantly ($p<0.05$) higher germination percentage than the untreated seed (control). Dithane M45 (fungicide)

Table 1. The effect of the neem products, Dithane and Actellic on the germination of treated seed maize (Zea Maize) after nine months of storage

TREATMENT (CHEMICAL)	CONCENTRATION OF CHEMICALS (%)	MEAN GERMINATION(%)
Neem seed powder	0.5	68.0 cde
Neem seed powder	1.0	66.0 cde
Neem leaf powder	0.5	81.0 bc
Neem leaf powder	1.0	76.0 bcd
Neem seed oil	0.5	52.0 e
Neem seed oil	1.0	18.0 f
Dithane M45	0.5	96.4 a
Dithane M45	1.0	88.8 ab
Actellic 25 EC	0.5	61.0 de
Actellic 25 EC	1.0	25.0 f
Control (untreated seed)	-	81.0 bc

Means followed by a same letter are not significantly different at p=0.05 according to DMRT.

probably controlled fungi occurrence which prevented fungal attack during the early stages of seedling development and thus probably had some stimulatory effect on germination. Among the neem products, seeds
treated with neem leaf powder had the highest germination percentage (81.0% and 76.0% at concentration of 0.5% and 1.0% respectively) which were significantly higher than those obtained for the neem oil. The values were not significantly different from that obtained for the control. It showed that neem leaf powder
had no adverse effect on the germination of seed maize. However, neem seed oil treatments had values which were significantly lower than that of the control. Neem seed powder at both concentrations had values which were lower than that of the control despite the fact that the differences were not significant. It was also observed during the germination test that most of the seeds treated with neem seed oil and neem seed powder germinated in the sand but they could not emerged from the medium (sand) to be counted normal seedlings. Neem seed have been reported to suppress fungal growth (8). Therefore, it is possible that the neem seed products may contained substances that were phytotoxic and suppressive to the developing embryo. Leukel (12), Potgeister and de Beer (13) reported that some seed treatment chemical had no effect on germination of
the seeds they tested, but in some cases stimulatory effects were reported while others showed depressive effects. It is also possible that the concentration of the neem seed oil and Actellic 25EC used was too high, thus showing phytotoxic effect on the maize seed embryo since significantly reduced germination percentage values were obtained when the concentrations were increased from 0.5% to 1.0% (W/W). In future trials, lower concentrations would be tested. The concentrations of the neem leaf powder, however, seemed to be low in this study and higher concentrations will be tested in future trials.

Table 2. The effect of neem products, Dithane and Actellic on the vigour index of maize after nine months in storage.

TREATMENT (CHEMICAL)	CONCENTRATION OF CHEMICALS (%)	MEAN VIGOUR INDEX (%)
Neem seed powder	0.5	1997 cd
Neem seed powder	1.0	1427 de
Neem leaf powder	0.5	1926 cd
Neem leaf powder	1.0	2354 abc
Neem seed oil	0.5	1164 e
Neem seed oil	1.0	981 ef
Dithane M45	0.5	2864 a
Dithane M45	1.0	2724 ab
Actellic 25 EC	0.5	1317 e
Actellic 25 EC	1.0	484 f
Control (untreated seed)	-	2228 bc

Means followed by a same letter are not significantly different at P=0.05 according to DMRT. Higher values means greater vigour.

Effect on seed vigour

The data on seed vigour showed that seeds treated with Dithane M45 were the most vigorous; this was followed by neem leaf powder treated seeds at 1.0% concentration (Table 2 and 3). Previous studies revealed that Dithane M45 completely controlled seed-borne pathogens while Neem leaf powder suppressed the seed borne fungi only better than the other neem seed products (8). Thus, the young seedlings from seeds treated with Dithane M45 and Neem leaf powder probably developed without much fungal disturbances and that accounted for the high vigour values (14).

Furthermore, the relatively low seed vigour values from the neem seed powder, neem seed oil and Actellic
treatments especially at 1.0% level of concentration when compared to the control could probably be due to the phytotoxic effects of the active ingredients on the maize seed embryo. This is because reduced vigour was generally observed when the concentration was increased from 0.5% to 1.0% (W/W). At the higher concentration, the young emerging seedlings might have been surrounded by a high concentration of the active ingredients at the sensitive stage of development as has been observed by other workers (15).

Consequently, the normal metabolic reaction might have been disturbed leading to low vigour of some of the seeds.

The relatively high vigour values for the 1.0% neem leaf powder treatment as compared to that of other neem products gave ample evidence that neem leaf powder did not have adverse effect on the vigour of seeds.

Table 3. The effect of neem products, Actellic and Dithane on the coefficient of velocity of treated seed maize after nine months in storage.

TREATMENT (CHEMICAL)	CONCENTRATION OF CHEMICAL (%)	MEAN VIGOUR INDEX
Neem seed powder	0.5	21.76 c
Neem seed powder	1.0	18.68 d
Neem leaf powder	0.5	19.42 d
Neem leaf powder	1.0	23.72 bc
Neem seed oil	0.5	18.88 d
Neem seed oil	1.0	19.46 d
Dithane M45	0.5	26.06 a
Dithane M45	1.0	24.70 ab
Actellic 25 EC	0.5	21.70 c
Actellic 25 EC	1.0	18.88 d
Control (untreated seed)	-	22.90 bc

Means followed by a same letter are not significantly different at P=0.05 according to DMRT. Higher values means greater vigour.

CONCLUSION

From the results of the present experiment, it can be concluded that neem seed powder and neem seed oil reduced both the viability and vigour of the treated seed maize and therefore they cannot be used as seed dressers. However, neem leaf powder, even at 1.0% concentration did not have any adverse effect on the viability and vigour and therefore it can be used as a seed dresser.

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