Minimizing Quality Losses during Maize Seed Processing in Postharvest Management

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Abstract

The quality loss assessment in maize (*Zea mays* L.) seed after processing was determined, in each step of conditioning and processing. Samples were taken from the first step by sampling during decreasing seed moisture content (drying) at arrival time, the second step was sampling during shelling, the third step seed was sampling during drying seed to 11 % moisture content, the fourth, seed was sampling during cleaning, the fifth step seed was sampling during grading and the last step of assessment seed was sampling during pesticide treatment. Quality assessment methods were standard germination test, viability test by enzyme activity, electrical conductivity test and seedling growth rate test, besides that the assessment for mechanical damage was also investigated during every step of processing. It was found that the high initial moisture content of the seed played a very important role in decreasing germination percentage and viability. After the seed was dried in the second step, the result showed the positive trends by keeping their qualities in satisfactory standard germination level (98-100%). Vigor assessment showed that well processed seed passed though all steps of this experiment (6 steps) resulted in a significantly differences in seed vigor compare to the seed from treatment in the first and the second step. There was no symptoms of mechanical damage in all treatments. Therefore, it could be concluded that processing maize seed has to be handled continuously in practicing from the first step to the end in order to achieved good quality seed if there is a need to stop any process, it is recommended to reduce the seed moisture until it reach a safety level (11%), then it could not be affected the seed quality.

Keywords: Maize , Processing, Loss, Postharvest

Introduction

Seed deterioration is a severe problem of seed industry, because commercial seed must have above excepted germination standard. The deteriorated seeds have low germination ability that can not be sold. Seed deterioration is not possible to stop totally but we can minimize the rate of deterioration. Seed conditioning can reduce the deterioration. Proper management in every step of conditioning must be adjusted and maintenance for optimum condition to get high ability to reduce seed deterioration. Normally, germination tests considered as quality test of seed during conditioning and it is indicated by germination percentage. It can not indicate the change of seed vigor and the step of conditioning.

Harvested ear from the field has to reduce seeds moisture content by drying which temperature is less than 45^{o}c is favorable for seed germination and vigor. Drying of seed at 50^{o}c causes damage of seed and at 60^{o}c causes germination loss, and at 70^{o}c all seeds can be

died (Navratil and Burris, 1984; Harrison and Wright, 1929). For shelling, optimum level of moisture content should be 13-20%. For preventing, reducing mechanical damage or cracking of seeds, speed of shelling machine is needed to adjust. Baker *et al.* (1991) found that drying, germination of shelled maize seed were affected greatly than the unshelled seeds. After shelling, seeds can be redried to reduce seed moisture content for good storage level (lower than 11 %) and cleaning to separate inert matter followed by grading and sizing. Seed may be treated before storage with dye, fungicide and/or insecticide.

In this research, we compared maize seed quality after passing each step of conditioning. To investigate the cause and effect of deterioration of seed for improving quality of seed conditioning process- germination percentage, seedling growth rate, seed leachates, enzyme deterioration and seed damage were used.

Materials and methods

Seeds of DK888 variety were planted and conditioned at department of Agronomy, faculty of Agriculture, Chiang Mai University, Thailand during the year 1998. Plot size was 20m x 20m, spacing was 25cm x 75 cm. and the harvesting was done after 105 days of germination. Seed sampling was done after passing each step of conditioning. Randomized Complete Block Design was followed with 4 replications. Each step of conditioning set as follows:

Step 1 - drying for reducing seed moisture content less than 18 % (P1)
Step 2 - shelling (P2)
Step 3 - drying for reducing seed moisture content to less than 11 % (P3)
Step 4 - seed cleaning (P4)
Step 5 - seed sizing (P5)
Step 6 - seed treatment (P6)

Seed sampling after passing each step of conditioning different tests were done as follows:

Standard germination test **:** It was done by following ISTA,(1985).
Membrane deterioration test : It was done by Electrical conductivity (AOSA, 1983)
Seed leachates : It was done by Tetrazolium test (ISTA,1985)
Seedling growth rate (SGR) : It was determined by ISTA, (1985)
Seed damage by Fast green test (0.1%)

Results and discussion

Statistical analysis was done by Analysis of Variance and comparison of difference was determined by Least Significant Difference (LSD) by Steel and Torrie (1960)

Table 1 shows that the lowest germination percentage in P2 seeds while P3, P4 and P5 show high germination percentage. Membrane deterioration was determined by electrical conductivity test and found in P1 seed significant lowest conductivity value (7.0 μ mhos/gram) while the highest value was in P5 seed (10.5 μ mhos/gram). But, the values of all steps of conditioning were lower than 24 μ mhos/gram while is accepted to high vigor seed.

Table 1 Germination percentage conductivity viability and seedling growth rate after pass each step of conditioning

Conditioning Process	Germination percentage	Conductivity (μ mhos/gram)	Viability	Seedling Growth Rate (miligrams/seedling/4days)
P1	86 b	7.0 a	90 b	23 bcd
P2	72 c	9.5 bc	61 c	22 cd
P3	98 a	9.1 b	99 a	24 abc
P4	97 a	10.0 cd	99 a	22 d
P5	99 a	10.5 d	100 a	24 ab
P6	100 a	-	100 a	25 a
F-Test	**	**	**	**
LSD 0.05	5.0838	0.8577	1.756	1.5647
CV	3.68	6.04	0.70	4.48

Increasing deterioration of cell membrane was observed when it was passing each step of conditioning. But this deterioration occurred in low level. From the results, It is showed that should not use this test without another vigor test. Because fungi infection could not detected and missed in loss of germination percentage of infected seeds. (Table 1)

From the Seed leachates determination, all steps showed high equal vigor but not viability. According to that test, in the high seed viability was found in P3, P4, P5 and P6 (99, 99, 100 and 100) while P1seed had 90 and P2 seed had 61 as lowest viability.

Highest significant seedling growth rate was in P6 seed (SGR=25 mgr/plant/4days) while P1, P2 and P4 seed showed (23, 22 and 22 mgr/plant/4days). Mechanical damage of seed did not found in all step of conditioning process.

P2 seed had less germination percentage due to shelled seed with high moisture content, which condition is favorable for *Aspergillus* spp. infection. It might be also found that black color in embryo, called “Blue eye”. Drying of seed less than 11% moisture content had advantage for germination percentage by reducing fungi infection showed in result of P3, P4, P5 and P6 seed.

Deterioration of dehydrogenate enzyme in each step of conditioning showed high vigor from the strains of seeds at all steps were uniform as bright red.

P6 Seed had highest in seedling growth rate compared with other steps. And this conditioning process has good operation and can be fit with maize seed conditioning that showed in result of mechanical damage test.

Conclusion

Deterioration of maize seed quality is highest in high moisture shelled seed (more than 11%MC). Because of fungi infection that shows lowest germination percentage, viability and seedling growth rate, while sized seed and treated seed has become high seed quality.

Conditioning process has good effect to maintain the seed quality of maize when continuous process from reduce seed moisture content to less than 18%, shelling and redrying of seed less than 11% moisture content. While cleaning, sizing and treating of seeds that can be operated afterwards for improving quality of seed in the storage. When passing all steps of conditioning, quality of seeds will be higher.

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