Effectiveness of different plant parts (Bio-pesticides) on preservation of wheat seed (*Triticum aestivum L.*)

Submitted in partial fulfillment of the requirements for the degree of Bachelor of Science in Botany, University of Rajshahi

Submitted By
Examination Roll: No. 08226440
Registration No: 3122
Taposhi Rabeya Hall
B.Sc. (Honours), Session: 2007-2008
Examination-2012

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Plant Breeding and Gene Engineering Lab.
Department of Botany
University of Rajshahi
Rajshahi, Bangladesh

DECLARATION

I do hereby declare that the whole work submitted as a project entitled **"Effect of Biopesticides on Seed Quality Storage of Wheat (*Triticum aestivum*)."** In the Department of Botany, University of Rajshahi, Rajshahi-6205, for the degree of **Bachelor of Science in Botany** is the result of my own investigation and was carried out under the supervision of **Dr. AKM. Rafiul Islam,** Professor, Department of Botany, University of Rajshahi, Rajshahi-6205, the project has not been submitted in the substance for any other degree.

Sazeda Akter

CERTIFICATE

It is my pleasure to certify that the research work presented in this dissertation entitled, **"Effect of Biopesticides on Seed Quality Storage of Wheat (*Triticum aestivum*)"** is submitted by Sazeda Akter to the Department of Botany, University of Rajshahi. Bangladesh for the degree of Bachelor of Science in Botany.

Dr. AKM. Rafiul Islam
Professor
Department of Botany
University of Rajshahi
Rajshahi-6205
Bangladesh

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ABSTRACT

In the present investigation one type of wheat cultivar was preserved. The wheat cultivar BARI Gom 27 evaluated for three quantitative characters viz., percentage of humidity, percentage of infected seeds and percentage of seed germination before sowing. The collected data were analyzed in order to estimate mean.

The effect of three treatments (dry neem leaf, dry mahogoni seed and dry neem seed) was different for storing the seed. The highest percentage of humidity (14.9%) was noticed in mahogoni fruit treated seed. On the other hand the lowest percentage of humidity (13.6%) was observed in dry neem seed, treated seed. The highest percentage of infected seed (2.03%) was noticed in dry neem leaf treated seed. The lowest percentage of infects seed (0.23%) was observed in dry mahogoni fruit treated seed. The highest percentage of germinated seed (89.73%) was observed in dry mahogoni fruit treated seed and the lowest percentage of germinated seed (85%) was noticed in dry neem leaf.

The dry mahogoni fruit was the best treatment than the other to treatments for storing BARI Gom 27. This treatment is suitable for seed storing in Bangladesh.

CHAPTER I

INTRODUCTION

1.1. BACKGROUND

Bangladesh, population 140 million, is the most densely peopled country in South Asia. It a generally subtropical monsoon climate. There are six seasons in the year. Three of them, namely winter (November-March), summer (April-June), and the monsoon (July-October), are prominent. In winter there is usually little fluctuation in temperature which ranges from a minimum of 7-13^{o}C (45-55^{o}F) to a maximum of 24-31^{o}C (75-85^{o}F). Summer maximum temperatures are around 37^{o}C (98^{o}F), although in some places this occasionally rises to 41^{o}C (105^{o}F) or more. The monsoon starts in July and runs till October. This period accounts for 80% of the total rainfall. The average annual rainfall varies between 119 and 145 cm (Anon. 1992).

In Bangladesh the total loss due to poor post-harvest processing and preservation of agricultural products when valued in monetary terms reflects a tremendous loss in the economy. In 1989-90 post harvest losses of rice, wheat, sugarcane, pulses, oil seed, vegetable, frits and root crops due to inadequate processing and preservation reached 4.96 MMT. These losses were valued in TK. 28957.90 million (US$ 503 million). The loss continued to increase and reached 5.14 MMT amounting to TK. 44865.00 million (US$ 779.45 million) in 1998-99. Deficits in food items or financial loss should not have occurred if post-harvest losses were

reduced through proper processing and preservation from harvest to consumption. Post-harvest losses in durable crops ranged between 10-15 percent; loss in semi-perishable crops was 15-30 percent and that of perishables, 25-40 percent (Hussain, 1993). So there is an argent need to take up programme for proper storage and processing of food.

The main aim of seed storage is to minimize the growth of micro organism during the storage period, thus promoting longer shelf life and reduced hazard from eating the food.

1.2. SEED STORAGE

Storage may be defined as the preservation of viable seeds from the time of collection until they are required for sowing (Holmes and Buszewicz 1958). When seed for afforestation can be sown immediately after collection, no storage is needed. The best sowing date for a given species being raised in a nursery depends on (a) The anticipated date of planting, itself dependent on seasonal climate, (b) The time needed in the nursery for planting stock of that species to reach the right size for out-planting. Only rarely does best sowing date coincide with the best date for seed collection. More often it is necessary to store the seed for varying periods which may be

1. Up to one year when both seed production and afforestation are regular annual events, but it is necessary to await the best season for sowing.

2. 1 – 5 years or more when a species bears an abundant seed crop at intervals of several years and enough seed must be collected in a good year to cover annual afforestation needs in intermediate years of poor seed production.
3. Long-term storage for purposes of conserving genetic resources. The period of storage will vary according to the seed longevity of the species and the storage conditions, but will be measured in decades in species which are easy to store.

1.3. IMPORTANCE OF SEED STORAGE

The Cereals, pulses, oilseeds etc. are very important products for storage. A safe storage place must be provided for the grain produced until it is needed for consumption and multiplication purposes. Since grain production is seasonal, and consumption is continuous, safe storage must maintain grain quality and quantity. This means that grains have to be protected from weather, molds and other microorganisms, moisture, destructively huge temperatures, insects, rodents, birds, objectionable odours and contamination, and from unauthorized distribution.

1.4. PRINCIPLES OF SEED STORAGE

(a) Removal of micro-organisms or inactivating them: This is done by removing air, water (moisture), lowering or increasing temperature, increasing the concentration of salt or sugar or acid in seed.

(b) Inactivating enzymes: Enzymes found in seeds can be inactivated by changing their conditions such as temperature and moisture.

(c) Removal of insects, worms and rats: By storing seeds in dry, air tight containers the insect, worms or rats are prevented from destroying it.

1.5. OBJECTIVES

- To identify the most suitable biopesticides for preservation of wheat seed.

CHAPTER II

MATERIALS AND METHODS

2.1. MATERIALS

2.1.1. Plant Materials

In this investigation wheat cultivar BARI Gom 27 and three types of biopesticides were used as planting materials which are given bellow:

i. Wheat (BARI Gom 27)
ii. Biopesticides:

Dry neem leaf

Dry mahogony fruit

Dry neem seed

2.1.2. Other Materials

i. Gunny bag
ii. Moisture meter

2.2. METHODS

The methods involved in the present investigation on are described under the different subheads.

2.2.1. Experimental site

The present research work was conducted in different farmer's house in three village of Paba upazila at Rajshahi, Bangladesh.

2.2.2. Time of Storage

Seed storage was conducted from 5 June 2013 to 8 November 2013.

2.2.3. Procedure

In the farmers house jute bag was cleaned properly and dried up in the sun. Seeds were also dried well so that the moisture of seed was 12%. Seeds were kept fully loaded so that no empty space remains. Baggs were tightened enough so that moisture and air exchange was prevented. Then jute bags kept on a wooden stage so that moisture from soil surface could not be absorbed. Jute bag was not open before sowing. There are three gunny bags in each farmer's house. Among the three bags 1st bag contain dry neem leaf, 2nd bag contain dry mahogany fruit and 3rd bag contain dry neem seeds.

2.2.4. Data Collection

Data were collected on the following parameters.

i. Humidity test

The percentage of humidity was estimated by moisture meter after 156 days of storage.

Formula by which count percentage of humidity.

$$\text{Percentage of humidity} = \frac{\text{Humidity of all tested seed}}{\text{Total number of tested seed}} \times 100$$

ii. Disease Incidence

To count the parentage of infected seed at first 100 seed were taken randomly. Then infected seed were counted from 100 seed.

Formula by which count percentage of infected seed.

$$\text{Percentage of infected seed} = \frac{\text{No of infected seed}}{\text{Total number of tested seed}} \times 100$$

iii. Germination test of Seed

At first the storage seeds were dried in the sun. Then some seeds kept on a pot of water for 12 hours. Then the seeds were put into a tissue paper for 12 hours. After 12 hours percentage of germinated seed were count.

Formula by which count percentage of germinated seeds.

$$= \frac{\text{Number of germinated seed}}{\text{Total number of tested seed}} \times 100$$

2.2.5. Technique of Data Analysis

The collected data were analyzed using biometrical technique developed by Mather (1949) based on mathematical model of Fisher *et. al.* (1932)

i) Mean

Data on individual plant basis were added together then divided by the total number of observation and the mean was obtained as follows:

$$Mean(\overline{X}) = \frac{\sum X_i}{N}$$

Where,

X = The individual number

N = Number of observation

i = 1,2,3,……n

$\sum$ = Summation

Analysis of variance

Variance analysis is a measurement of dispersion of a population. So, for testing the significant difference among the populations the analysis of variance is necessary. Variance analysis for each character was carried out separately.

The variance due to different source such as replication (R), treatment and within error of a population were calculated.

Analysis of variance (ANOVA Table)

Source	**Degree of Freedom**	**Sum of Squares**	**Mean Square**	**F Value**
Location				
Treatment				
Error				

Test of Significance

Analysis of variance provides the basis for test of significance. Significance of differences among the population were worded out by F test (variance ratio) as follows:

$$\text{F-test} = \frac{\text{MS}}{\text{Mse}}$$

Where, MS = Mean square

Mse = Error mean Square

LSD: (Least Significant Difference)

$$LSD = t_{(0.05)} \times \sqrt{\frac{2\,Mse}{r}}$$

Here,

$t_{(0.05)}$ = Table value of 5% significance level at error df.

Mse = Error Ms

r = Replications

CHAPTER III

RESULTS

In the present study BARI Gom 27 was evaluated for three quantitative characters viz, percentage of humidity, percentage of infected seeds and parentage of seed germination before sowing. The collected data were analyzed in order to estimate mean. The results derived from different statistical analysis are described under different heads.

3.1. PERCENTAGE OF HUMIDITY

From the **Table 1** appears that the percentage of humidity in storage seed was not same. So the effects of biopesticides on humidity were different for every treatment. The highest percentage of humidity (14.9%) was noticed in mahogoni fruit treated seed. On the other hand the lowest percentage of humidity (13.6%) was observed in dry neem seed, trteated seed.

From the **Table 2** it appears that the three biopesticides were significantly different for percentage of humidity.

Table 1. Treatment replication with mean for percentage (%) of humidity after storage

Treatment	R_1	R_2	R_3	Mean of replications
Dry neem leaf	15.2	14	15.35	14.85
Dry mahagoni fruit	16	15.50	16.20	14.9
Dry neem seed	13.5	14.20	13.10	13.6

ANALYSIS OF VARIANCE

The analysis of variance for all the three quantitative characters was done separately and the results are shown in **Table 2.**

Table 2. Analysis of variance for percentage humidity after storage

Source of variation	SS	df	MS	F	LSD (5%)	LSD (1%)
Treatment	7.955	2	3.9775	9.022684***	0.721756	1.050083
Replication	0.211667	2	0.105833	0.240076		
Error	1.763333	4	0.440833			
Total	9.93	8				

*** Significant at 0.1% level

3.2. PERCENTAGE OF INFECTED SEED

The results are presented in **Table 3** the effects of biopesticides to prevent disease was good. But the effect of three treatments (dry neem leaf, dry mahogoni fruit and dry neem seed) was not same. The highest percentage of infected seed (2.03%) was noticed in dry neem leaf treated seed. The lowest percentage of infected seed (0.23%) was observed in dry mahogoni fruit treated seed. So to inhibit the disease, the dry mahogoni fruit was better than the other two treatments.

From the **Table 4** it appears that the biopesticides were significantly different for percentage of infected seed.

Table 3. Treatment replication with mean for percentage of infected seed.

Treatment	R_1	R_2	R_3	Mean of replications
Dry neem leaf	2	2.25	1.85	2.03
Dry mahagoni fruit	0	0.50	0.20	0.23
Dry neem seed	1	1.25	1.80	1.02

Table 4. Analysis of variance for percentage of infected seed

Source of variation	SS	df	MS	F	LSD (5%)	LSD (1%)
Treatment	4.887222	2	2.443611	197.6854***	0.12086	0.175839
Replication	0.2600556	2	0.130278	10.53933		
Error	0.049444	4	0.012361			
Total	5.197222	8				

*** = Significant at 0.1% level

3.3. PERCENTAGE OF GERMINATED SEED

From the **Table 5** it appears that the percentage of seed germination was different for every treatment. The highest percentage of germinated seed (89.73%) was observed in dry mahogoni fruit treated seed. The lowest percentage of germinated seed (85%) was noticed in dry neem leaf.

From **Table 6** it observed that three treatments were significantly different for percentage of seed germination.

From the analysis it is considered that the dry mahogoni fruit was the best treatment than the other two treatments (dry neem leaf, dry neem seed) for seed storing.

Table 5. Treatment replication with mean for percentage (%) of germination

Treatment	R_1	R_2	R_3	Mean of replications
Dry neem leaf	85	84.00	86.00	85
Dry mahagoni fruit	90	88.20	91.00	89.73
Dry neem seed	86	85.00	87.20	86.06

Table 6. Analysis of variance for percentage of germination

Source of variation	SS	df	MS	F	LSD (5%)	LSD (1%)
Treatment	36.98667	2	18.49333	277.4***	0.280677	0.408358
Replication	8.186667	2	4.093333	61.4		
Error	0.266667	4	0.066667			
Total	45.44	8				

*** = Significant at 0.1% level

Plate: Storage seed using dry neem leaf

Plate: Storage seed using dry neem

Plate: Storage seed using three treatments

Plate: Storage seed using dry mahagoni fruit

Plate: Observation of Storage wheat seed (BARI Gom-27)

CHAPTER IV

DISCUSSION

Wheat is an important food crop in Bangladesh. In this country every year many farmers were stored some crop seed for next cultivation. As farmers store their crop seed for only short periods, their problem are less significant. But the farmers who store their crop for long time and at the trader's level that the incidences of insect, pest and disease are major problem. Most of the farmer in Bangladesh are poor. So they can not store their seed by refrigeration, freezing and cold storage. In this situation many farmers avoid pest infection by biopesticides.

The indigenous techniques and uses of biopesticides are reducing very fast in all over the world, but in case Uttarakhand Himalaya, these are still the back bones of seed conservation for the next cropping season. Consequently, indigenous methods of seed and grain protection are becoming more popular because of their eco friendly and harmless nature for the whole environments. These eco friendly pesticides may provide the alternatives to the chemical pesticides and also can provide a sustainable base for the conservation of plant genetic resource. By using indigenous methods of plant protections, we can protect our environment in many ways. Indigenous methods of plant protection have largely been used in developed agrarian societies. Chemical control methods are more popular for providing quick solution, but these are neither sustainable nor

eco-friendly for the universe. A poor farmer can also apply it without involving any cost in terms of currency.

The uses of various plant parts as storage pesticides, because these plant parts emit a pungent type smell. This is because availability of essential oil in the plant parts. The emission of a kind of smell acts as a repellent of insect and deters their survival.

Farmers practiced in indigenous methods of keeping mahogoni fruit leaves along with the stored crop seed in gunny bag to control the storage pests. Mahogoni seed are known to have insecticidal property, to control any storage pests. Many farmers of Bangladesh and India adopted this indigenous storage practice in crop seed. Mahogoni fruit when added with the grains during storage, repel storage pest effectively. Farmers found this method very economical and effective in protecting the crop seed from storage. Crop seed be store in this method even up to one year. This indigenous storage method of crop seed is highly fesible and accepted among the farmers of different agro climatic zones of Tamil Nadu, India.

In the present investigation to study the performance of three biopesticides for seed storing was carried. In this investigation three quantitative characters were studied for three treatments (dry neem leaf, dry mahogoni fruit and dry neem seed).

In this investigation it was appear that the highest percentage of humidity (14.9%) was observed in mahogoni fruit treated seed storage and the lowest percentage of humidity (13.6%) was noticed in dry neem seed treated seed storage.

The highest percentage of infected seed (2.03%) was found in dry neem leaf treated seed storage and the lowest percentage of infected seed (0.23%) was observed in dry mahogoni fruit treated seed storage.

Percentage of seed germination by mahogoni treated seed shown the highest value (89.73%) and the lowest percentage of germination noticed in dry neem leaf treated seed. It shows that the effects of three biopesticides are not same. Among the three treatment dry mahogoni fruit was better than other treatment for seed storing. Similar results were obtained by Karthikeyan. *et al.* (2006) in crop seed. Baqui. *et al.* (1994) also found the same result.

From the result presented by Narayanasamy (2002), it was observed that the mahogoni is the better treatment than other biopesticides. Similar result were also reported in crop seed by Vivekanandan P (1994).

Finally it may be concluded that the dry mahogoni fruit is superior to other two treatment (dry neem leaf and dry neem seed). So this treatment is suitable for seed storing in Bangladesh.

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