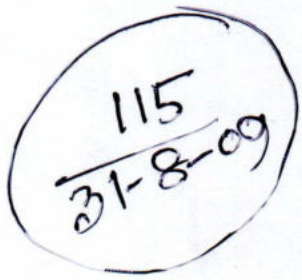
QUALITY STUDY OF RADISH (*Raphanus sativus*.L) SEED cv. TASAKI MULA IN DINAJPUR AND RANGPUR DISTRICT

A THESIS
BY

Md. Tarequl Islam
Registration No. 0705020
Session: 2007-2008
Semester: July-December



MASTER OF SCIENCE (MS)
IN
PLANT PATHOLOGY

DEPARTMENT OF PLANT PATHOLOGY
HAJEE MOHAMMAD DANESH SCIENCE & TECHNOLOGY UNIVERSITY
DINAJPUR

DECEMBER 2008

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Submitted to the
Department of Plant Pathology
Hajee Mohammad Danesh Science & Technology University, Dinajpur
in partial fulfillment of the requirements for the degree of

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Approved as the style and content by:

(Prof. Dr. Md. Mamunur Rashid)
Supervisor

(A. T. M. Shafiqul Islam)
Co-supervisor

(Prof. Dr. Md. Mamunur Rashid)

Chairman
Examination committee &
Head, Department of Plant Pathology
Hajee Mohammad Danesh Science & Technology University
Dinajpur

DECEMBER 2008

DEDICATED

TO

MY BELOVED PARENTS

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First of all the author would like to express his deepest and heartfelt greatness to Almighty '**Allah**' who enabled him to pursue his education in Agriculture discipline and to submit the thesis for the degree of MS in Plant Pathology, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur.

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The Author

ABSTRACT

In total 45 seed samples of radish cv. Tasaki mula were randomly collected from 40 farmers of four upazillas (Birgonj, Kaharol, Badargonj and Taragonj) comprising 10 farmers from each of the upazilla and five companies (Molla seed company, Supreme seed company, Lal teer seed company, Metal seed company and Alamgir seed company) were collected from Dinajpur local seed market during the period of April to September 2007 for testing their quality and health status. In field study, the field emergence of farmer's seed samples ranged from 53.70-61.40% and company's seed samples were found 50.50-73.00%. The plant stand of farmer's seed samples was found 37.20-44.40% and in company's seed samples were found 33.50-58.00%. In laboratory study, the germination percentages were recorded 64.92-77.95% in farmer's seed samples and 42.50-85.00% in company's seed samples. In case of apparently diseased seed 22.20-64.00% were recorded in farmer's seed samples and 22.07-39.75% in company's seed samples. The vigor indexes were recorded 917.32-1220.70 in farmer's seed samples and 531.68-1395.70 in company's seed samples. The highest percentage of *Alternaria* infected seed was observed 25.30% in Taragonj upazilla's seed sample and the lowest 22.40% in Birgonj upazilla's seed samples, where the highest 22.50% *Alternaria* infected seed was recorded in Molla seed company's seed sample and the lowest 17.25% was recorded in supreme seed company's seed sample. Finally it may be concluded that, company seed samples were superior in quality than farmer's seed samples regarding all parameters.

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CHAPTER 1

INTRODUCTION

INTRODUCTION

Radish (*Raphanus sativus*.L) belonging to the family Cruciferae is a popular and widely grown vegetable in Bangladesh as well as in the different part of the world. It has different uses as dish item like vegetable, green leaf, salad, pickle and sauce. Rashid(1976) sited that a hundred gram of edible root contain 1% protein,4% CHO,15 calories, negligible vitamins A, 0.3 mg thiamin, 0.03 mg niacin, 25 mg vitamin C, 30 mg calcium and 1 gm iron. At present China, India, USA and Turky are holding the position 1st, 2nd, 3rd, and 4th, respectively for radish seed production. In Bangladesh radish is cultivated in an area of 23.48 thousand hec. of land with a production of 85.42 thousand metric ton. The average yield of radish is 1.47 mt/ha, which is very low in Bangladesh (Anon. 2004). Radish is the third most important vegetable crop next to potato and egg plant, fifth most important as vegetable seed crop next to Onion, Amaranth, egg plant and Chilies in respect of total acreage (44000 ha) and first most important seed crop in respect of actual consumption (577 ton annually) for 140 million inhabitants of Bangladesh (Anon. 1997). Now a day this crop is cultivated all the year round. At present 445 tons of radish seed are produced in 44000 hectors of land in the country. Total requirements of radish seed in Bangladesh are above 700 tons for vegetable purposes (Anon. 1997). About the total requirement 48 % is locally produced by government, NGO, s and some seed companies and rest 52% is imported from abroad (Anon. 2005). The cultivation of radish as seed crop has become very popular with some of the vegetable growers of the Dinajpur and Rangpur region of Bangladesh. Seed production of radish is very specific in its climatic requirements. The high yielding radish varieties popularly cultivated in Bangladesh are of biennial type that does not produce good seeds in our field conditions. A tropical annual type variety named Tasaki was developed by the Bangladesh Agricultural Research Institute is capable

of producing seeds abundantly under the local conditions. (Rashid *et al.* 1985).Enough high quality healthy radish seed is not at all available in the country. The average seed yield of the crop is below 0.5 t/ha whereas if the modern technology is followed seed yield will be increased 2.5t/ha in our country. Thus the seed yield of the crop in the country is relatively much lower even though very favorable environment prevail every year, a huge amount of radish seed is imported from outside of the country with considerable amount of foreign currency.

Radish has a number of diseases, of which blight (*Alternaria* spp.) is serious threat to the seed crops. Among three *Alternaria* species, *A.brassicae* mainly causes the disease in the radish seed crop (Hussain, 1983). Alternaria spot caused by *A. brassicicola, A. brassicae* is an important and severe seed-borne fungal disease of brassica crop world wide (Kolte, 1885; Tewari and Conn, 1988; King, 1994; Rotem, 1998; Meah *et al.*2002). The pathogen can be transmitted to decedents by direct infection of development seeds in siliquae causing severe damage in seedlings (Kubota *et al. 2003*).Typical symptoms of this disease are dark brown spot on leaf ,stem and siliquae ,which begin as small brown or black spot that usually enlarge in to concentric circle in later stage .Furthermore ,they often show chlorotic margins and reduce the photosynthetic capacity of the infected plant and lead the premature senescence of the leaves(King 1994).There is no accurate estimate about the loss of seed yield of radish due to Alternaria blight about 46.38% seed yield is lost due to this disease (Meenu and Hundal, 2004).Farm manager Rezaul Hoque (East-West Seed Bd Ltd.) reported that yield losses due to *Alternaria* are ''common and severe'' and greater Dinajpur district is the best area for radish seed production in Bangladesh. He opined that seed yield losses due to this disease about 30-50 percent and varied from year to year. Besides these pathogens may also be a means by which soft rot bacteria enters the stem ,

and leads the plant to death specially after transplanting (Anon,2005).Seed is the main infection source of *Alternaria brassicae, Alternaria brassicicola* and *Alternaria raphani* of radish , serves as a substrate for pathogen survival ,of destructive diseases for seed growers. The pathogen can shrivel seeds within the pods or kill the pod stalks before seed formation. They may also be a means by which bacterial soft rot pathogen enters the stem, which may lead to plant death (Chupp and Sherf, 1960), Neergaard (1945) reported that the disease infected 90% of various Brassicaceae seeds commercially available in market. So the selection of apparently healthy seed could be the easiest and economical practice for the grower to avoid the pathogen. Control of the disease is very difficult due to various sources of inoculums and wide range in conidial dispersal and uncertainty of the level of disease, where as several protective fungicides effectively control the disease (Hossain and Meah, 1990). High quality seed means the seed must be genetically pure with high germination capacity and yield potential. The important parameters for judging seed quality are seed purity, seed size, seed moisture content, germination, health aspect and vigor. It is fact that no appreciable and significant research work has yet been conducted on seed borne nature of fungi, their effect on storage, germination and seedling infection as well as on different aspects of Alternaria blight of leaf and pod of radish in Bangladesh. A number of chemicals have been tried against *Alternaria brassicae* in mustard with varying degrees of success (Anon. 1981, Atika and Ahmed 1985, Hug and Ahmed 1985, Hossain 1985, Howlidewr *et al.,* 1985 and Meah *et al.,* 1986). Therefore, information on the seed borne nature of fungi caused by *Alternaria* species, particularly on radish seed crop, is very limited in this country. However, a routine work on control of radish disease especially on fungicidal application is being carried out in BARI (Mondal *et al.,* 1989). *Raphanus sativus* is an important vegetable seed crop. In these situations healthy seeds are required to produce healthy seed and crops.

As mention earlier, no significant and appreciable research work has yet been conducted on seed quality of radish in Bangladesh. Therefore the present study was to determine the different aspect of seed quality including emphasizing on prevalence of *Alternaria* in the seed of radish collected from different upzillas and Companies in the region of Rangpur-Dinajpur district with following objectives

- To study the quality of farmers seeds of radish.
- To study the quality of the company seeds of radish.

CHAPTER 2

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Alternaria is considered as the serious pathogen of radish seed crop. A huge number of research works has been carried out on this pathogen regarding its physiology, pathogenicity, and control. But association of this pathogen with seeds of radish before and during storage in Bangladesh is not yet elaborately studied. Literatures on seed-borne *Alternaria* nature are summarized below.

Rangel (1945) reported that the destruction of a cruciferous seed crop including radish due to *Alternaria*. The pathogens could live within the seed, spread the disease to other fields and caused a loss of seedlings. The *A. brassicae* and *A. brassicicola* remained viable for a long period as spores on seed coat or as mycelium in seed as well as in infected plant debris of radish. Twenty month-old seed samples infected with *A. brassicae* that were stored at 0^0 C for fourteen months showed high germinability. *A. brassicae* cultures exposed to outdoor weather for a six-month period in which temperatures ranged from -23 to 30^0C showed that the spores were still viable and pathogenic.

Chupp and Sherf (1960) stated that the continuous moisture of 24 hours or longer practically guarantees the of infection of radish plant by *A. brassicae* and *A. brassicicola*.The common symptom of broccoli, cauliflower and radish infection. That occurred as browning on the head. Fruit-bearing branches and seedpods showed dark or blackened spots that resulted in yield loss due to premature pod ripening and shedding of the seeds. Infection could also occur on the fruit, before or after harvest. All three pathogens (*A.brassicae, A. brassicicola* and *A. raphani)* were destructive

diseases for seed growers. The pathogens could shrivel seeds within the pods or killed the pod stalks before seed formation. They may also be a means by which bacterial soft rot entered the stem, which might lead to plant death. They described that the late infection, or infection of older leaves, did not characteristically reduce yields, and could be controlled through intensive removal of infected leaves.

Maude and Humpherson-Jones (1980a) studied that the Brassicas seeds infected with *A. brassicicola* were known to have active surface spores for up to 2 years when the seeds were stored at 10^0 C with 50% relative humidity. Internal mycelium of seed could remain viable for up to 12 years; infected plant debris was also a major source of spores, which could survive up to 12 weeks. This is a potential problem for crops that were planted in a recently harvested field. They also stated that the infected seeds with spores on the seed coat or mycelium under the seed coat of radish were likely the main sources of transport for *A. brassicae, A. brassicicola* and *A. raphani* pathogens.

Degenhardt *et al.* (1982) reported that the *A. brassicae* of rapeseed germinates over a wide range of temperature 8^0C to 31^0C, but occurs most quickly even within 3 hours, when the temperature is between 21 and 28^0C, 98% of the spores were germinated. *A. raphani* and *A. brassicicola* germinate (*in vitro*) at higher temperatures (tested at a temperature range of seven to 31^0C). The optimum temperature for *A. raphani* was 23^0C or greater is after 6 hours of incubation, 98% of the spores were germinated. The lowest temperature where 98% of the spores germinate was at 13^0C, which requires 10 hours of incubation. *A. brassicicola* begun to germinate 98% of its spores at 15^0C after 10 hours of incubation and 98% germination occurred after 3 hours at 31^0C. Free water or high humidity was required for germination and

infection (at the same levels as reported for *A. brassicae*). The presence of moisture in the form of free water or high relative humidity (at least 95%) was required for germination.

Anonymous (1983) reported that disease survey of various crops of nine districts namely, Barisal, Chittagong, Comilla ,Dinajpur , Dhaka , Jamalpur , Jessore , Pabna and Rangpur. The highest and lowest incidence of leaf blight of mustard was recorded at Barisal (96.52%) and Dinajpur (65.35%) respectively.

Anonymous (1984) recorded the fungal infections on the seeds of mustard. The maximum seed-borne infection of *Alternaria brassicae* , *A.brassicicola, A.raphani* and *A.tenuis* were detected at Jessore (16.5%), Jessore (28.0%), Manikgonj (23.0%) and Jessore (9.5%) respectively while minimum incidence was recorded at Savar in case of all spices.

Mridha and Wheeler (1993) reported that a pathogenic fungus *Alternaria brassicae* was isolated from 97.6% of 84 seed samples of mustard collected from different localities of Chittagong and Comilla districts. About 41%of infected seeds failed to germinate and 73.4% of seedlings died after germination.

Suhag *et al.* (1986) studied in details the incidences of *Alternaria alternata* at moisture levels of 8, 10 and 12% after storage periods of 30, 60 and 90 days on radish seed, increased incidence of the storage fungi with increasing moisture levels.

Stovold *et al.* (1987) detected *A. brassicae* at varying levels on rape seed from different climatic districts of New South Wales during 1983. Highest levels were on seed samples from the South West Slopes (North) and Riverina (av. 22.8% and 14.2%, respectively) with much lower levels of infection (av. < 8% on samples from central and northern districts). Above average rainfall and below average temperature during spring probably accounted for the higher incidence in southern districts. When samples were retested 3 months after the initial testing, the level of seed-borne pathogen *(A. brassicae)* declined by 50% in samples from southern districts. Two samples of infected seed were treated with 1prodione at 1.25 g a. i. /k.g seed and the level of seed-borne *A. brassicae* was reduced from 21.0 to 40% and from 14.0 to 45%. The same treatment eliminated *A. brassicae* from pieces of trash mixed with seed. He assessed Germination over six months after treating the healthy seed with iprodione (1.25 g a. i. /kg) and omethoate (7.0 g a- i. /Kg) alone and in combination. iprodione had no effect on germination but omethoate alone and in combination with iprodione caused a significant reduction in germination. Samples of seed contaminated with different levels of *.4. brassicae* were analyzed for several quality components. The level of seed-borne pathogen by *A. brassicae* did not affect quality factors.

Vannacci and Pecchia (1988) found *A. raphani* in all parts of the infected radish seed and conidia on the seed coat. He concluded that the amount of inoculums decreased with depth in the seed. Most infected seeds germinated, but they were either rapidly overgrown by the pathogen or gave diseased seedlings. When sown in soil, a large proportion of diseased seedlings died before emergence. He got the result, infected seeds: infected plants (including decayed seed) ratio approached 1:1. Chlorine pretreatment reduced the percentage of infected seeds, but also

reduced germinability. During germination, the pathogen colonized the growing seedling structures, resulting in infection of the entire epicotyl-hypocotyl axis and of most cotyledons. He observed that the most seed coats adhering to the hypocotyls base, enabling some cotyledons to escape infection.

Mondal *et al.* (1989) stated the symptoms of altemaria blight of radish caused by *A. brassicae and A. brassicicola.* This disease caused black spots on leaves, stem and pods resulting in the loss of both yield and quality of seed.

Valkonen and Koponen (1990) stated that *A. brassicae* and *A. brassicicola* are seaborne pathogen of radish seeds. They reported that this pathogen reduces the germination resulting the damping-off or stunted seedling. *A. raphani* produced black stripes or dark brown, sharp-edged lesions on the hypocotyls of the seedling. It grew in the vascular system and rapidly infected the entire seedling. When older plants became infected, alternaria symptoms often occurred on the older leaves, since they were closer to the soil and were more readily infected as a consequence of rain splash or wind blown rain.

Tylkowska and Holubowicz (1991) evaluated the mycological performance of two samples of commercial radish seeds of cultivar Saxes by using both met Polish seed quality standards as first class seeds. They analyzed half of the seeds subjected to accelerated ageing (AA). At the same time, seed vigor tests were conducted and measured: mean germination time, speed of germination, total number of germinating seeds, germination capacity (first and final count), total shoot + root length, and lengths of hypocotyls and roots. It was found that the two samples differed significantly with regard to their fungal infestation,

seed germination capacity, and shoot+ root length. AA significantly delayed and prolonged seed germination, although it did not affect the total number of germinating seeds. Seventeen species of fungi were identified, principally in the genus *Alternaria.* AA significantly reduced the level of infestation. The sample, which highly infested with fungi had lower values of germination capacity in both the first and final count and had shorter shoots + roots. It was demonstrated that the incidence of *Alternaria spp.* and their location might be a valuable indicator of radish seed vigor.

Gupta and Chawdhury (1992) opeined that the *A. brassicae* was the most severe and widely prevalent pathogens in Sikkim, infecting all 6 Cruciferous crops examined. *A. brassicicola* was found on mustard, cabbage and cauliflower; *A. raphani* was severe on radish and infected also mustard

Hossain *et al.* (1994) found that lower germination in farmer's radish seed due to higher infestation of pathogen, which have negative relationship between pathogen percent and the germination of seeds.

King (1994) stated that the fungus was propagated by conidia produced in chains. They survive as mycelium or conidia on cruciferous seeds and in crop debris. Superficial contamination of the seed by the pathogens has been shown to persist for up to two years and internally the fungus could be survived for at least 12 years.

Das *et al.* (1998) stated that radish seeds stored in plastic containers, polyethylene bags or cloth bags at room temperature (23 $\pm$ 4^0C) or in cold storage (4 $\pm 1^0$C) for up to 8 months and cold-stored seeds maintained a significantly higher germination percentage and better seed vigor than those

stored at room temperature. With the increase in the duration of storage, the reduction in seed germination, percentage seedling survival and seed vigor were greater under ambient conditions than in cold storage. Irrespective of the storage conditions, seeds kept in airtight plastic containers or polyethylene bags gave better results than those stored in cloth bags.

Shrestha *et al.* (2000) found *Alternaria brassicae* predominantly in the seed coat and rarely in embryos of rapeseed *(Brassica campestris* var. *toria)* and mustard *(Brassica juncea).* The fungus sporulated profusely in the helium region when tested by the deepfreeze blotter method. In most cases *A. brassicae* sporulated within diseased tissues. They stated that survival of inoculums in stored seeds at low temperature and movement of infected seeds from gene banks to within a country or in other countries of the world.

Pandey *et al.* (2002) screened sixty-nine radish lines for resistance to Alternaria blight *(Alternaria raphani)* under artificial disease conditions based on percent disease index (PDI), area under disease progress curve (AUDPC), rate of infection (RI) and periodic disease progress. He found in general, all cultivars were moderately susceptible to highly susceptible to the disease.

Pestsov *et al.* (2003) carried out an experiment on recently introduced promising vegetable crop radish. Investigations were conducted at the experimental station with cultivars Sasha, Drakon, Dubinushka, Menovasi and Rozovyi bleask and Misato of Russia during 1997-2001. Symptoms were reported caused by *Alternaria brassicicola, A. consortiale.* Information included on fungal pathogens found on stored seeds. Cultivars Drakon,

Menovasi and Rozovyi bleask and .misato were the most resistant, while seed treatment with Agat-25k *(Pseudomonas chlororaphis)* was the most effective.

Meenu and Hundal (2004) carried out an experiment on Alternaria blight of radish seed crops caused by *Alternaria brassicae* during 2001-2002 and obtained the highest seed yield (823.13 kg/ha) from the 10th December transplanting under natural wetness condition with chemical treatments and the lowest seed yield (441.33 kg/ha) from 10th January transplanting control plot. They found the highest yield losses 46.38%.

Patni *et al.* (2005) stated that the Alternaria blight *(A. brassicae)* of mustard and radish was an economically important disease in many parts of the world. The disease caused very severe losses both in term of quantity and quality.

Pradip and Prajapati (2005') studied the *Afternaria brassicae* causing Alternan'a blight of radish that remained viable in diseased plant debris under both laboratory and field conditions (Uttar Pradesh, India) for seven months until the next sowing season. Plant debris stored in the laboratory and field conditions caused infection in 16.6% seedlings and 11.5% seedlings respectively. They found 30.7% and 23.0% infected seedlings under naturally and artificially infected seeds that were sown in autoclaved soil respectively. Sterilized seeds sown in naturally infested soil resulted in. 15.3% disease incidence while 18.5% infected seedlings were observed in sterilized seeds sown in autoclaved soil.

Boughalleb *et al.,* (2006) found four species of seed-borne fungi after incubation of radish seed samples on potato dextrose agar at 25°C. They found *Alternaria dauci, A. tenuissima, A. alternate and Epicoccum sp.* Seed treated with fungicides such *as* Maneb, Mancozeb, Benomyl and

Thiophanate methyl could reduce the infestation levels of tested crop. Found a conclusion that *Alternaria* is a genus of ascomycete and its species are known as major plant pathogens. Leafy crucifers can be attracted by these pathogens. The fungus is carried over in crucifers' seed, on weed, volunteer hosts or on unrecompensed crop residues. Use of healthy seed, crop rotation and foliar spray of fungicides are the ways of controlling this disease.

CHAPTER 3

MATERIALS AND METHODS

MATERRIALS AND METHODS

3.1 EXPERIMENTAL SITE

The experiment was conducted in the laboratory of Department of Plant Pathology, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur..

3.1.1 Land topography and soil

The experimental site belongs to the non-calcareous grey flood plain under AEZ (Agro Ecological Zone) 1 of Bangladesh and situated at latitude 25.5° N and longitude of 88.2° E. The soil type and other characteristics of the soil are given below (Anon. 1994).

Characteristics of AEZ-1

Name	: Old Himalayan Piedmont Plain
Land Type	: Medium High Land
Soil pH	: 5.5
Soil Texture	: Sandy loam with low water holding capacity
Temperature	: Maximum 26^0 C (Annual average)
% RH	: 85.5 (Annual average)
Rainfall (mm)	:18025.0 (Annual average)

3.2 EXPERIMENTAL PERIOD

The experiment was carried out during the period of 2007-2008.

3.3 COLLECTION OF SEED SAMPLES

A total of 40 seed samples of radish cv. Tasaki mula were collected from 40 farmers of Birgonj, Kaharol upzilla of Dinajpur district and Taragonj and Badargonj upzilla of Rangpur district (10 samples from each upzilla). Five companies' seed samples were collected from Dinajpur local seed market. Collected seed samples were then kept in

cellophane bag and stored in the refrigerator at 5-7° c. Before store the samples wer
labeled carefully. An upto date list of all the selected farmers under the study area
were collected with the helph of SAAO of DAE. Fifteen farmers from each were
selected thus a total sixty seed growers were selected and seed samples were collected
following the ISTA rules 1996 for analysis the quality.

Table 1. Selected upazilla, farmers and companies.

Sample no	Place of collection	Name of the Farmers/Company
1	Birgonj	Md. Shahidul Islam
2	,,	Md. Zahurul Islam
3	,,	Md. Abdul kader
4	,,	Md. Mojibar Rahman
5	,,	Md. Aminul Islam
6	,,	Md. Shafiar Rahman
7	,,	Md. Ahsan Habib
8	,,	Md. Motaleb Miah
9	,,	Md. Doko mia
10	,,	Md. Abdul motin
11	Kaharol	Md. Sfiar Rahman
12	,,	Md. Shafikul Islam
13	,,	Md. Zamser Ali
14	,,	Md. Zahedul Islam
15	,,	Bijoy Chandro Roy
16	,,	Md. Ajgor Ali
17	,,	Jotindra Nath Roy
18	,,	Md. Motiar Rahman
19	,,	Md. Abdul Mojid
20	,,	Dharmadev Roy
21	Badargonj	Md. Mohsin Mia
22	,,	Badal Roy
23	,,	Md. Anamul Hoque
24	,,	Md. Mosiur Rahman
25	,,	Sree Setalal Roy
26	,,	Md. Abdul Rashid
27	,,	Md. Rakibul Islam
28	,,	Md. Rafiq Mia
29	,,	Md. Amir Hossain
30	,,	Md. Abdul Motin
31	Taragonj	Md. Ataur Rahman
32	,,	Md. Obaidul Rahman
33	,,	Md. Abdul Zabbar
34	,,	Md. Atiar Rahman
35	,,	Md. Tobarak Hossain
36	,,	Md. Abdul Mozid
37	,,	Md. Hossain Ali
38	,,	Md. Abu sayed Mondol
39	,,	Md. Moksed Ali
40	,,	Md. Monto Mia
41	Dinajpur market	MOLLA SEEDS
42	,,	SUPREEM SEED CO.Ltd
43	,,	LAL TIR SEED
44	,,	METAL SEED
45	,,	ALAMGIR SEED

3.4 QUALITY STUDY OF THE SEED SAMPLE

The total fourty-five seed samples (40 farmer's seed and five companies' seed) cv. Tasaki mula of radish were tested for seed quality on the following parameters:

- Purity
- 1000 seed weight
- Apparently healthy seed (%)
- Diseased seed (%)
- Moisture content (%)
- Germination (%)
- Normal seedling (%)
- Abnormal seedling (%)
- Root length(cm)
- Shoot length(cm)
- Vigor index
- Field emergence
- Plant stand
- *Alternaria* infected seed (%)

3.4.1 Purity

The purity analysis of the collected seed sample was done by the method of ISTA rules 1976. The 30gm working sample was separated into the following three parts: pure seed, other seed, inert matter and the percentage of each part was determined by weight.

Pure seed: The pure seed will be referred to the species of *Raphanus sativus*, seed with testa, piece of seed larger than one-half the original size.

Other seed: Seed was referred seed units of any plant species other than that of pure seed.

Inert matter: Inert matter was referred seed units and all other matters and structures not defined as pure or other seed. Pieces of broken seed or damaged seed units half or less than half the original size. Seed without testa and unattached chaff, stems,leaves,soil, sand, stone and all other non-seed matter. The pure seed component was used to analysis of germination and health test.

3.4.2 1000 seed weight

The number of seeds in a weighed quantity of pure seed was counted and weight per 1000 was calculated (IRST, 1996, Huda, 2001).For the determination of 1000 seed weight, at least representative sample of (30gm) will be used.

3.4.3 Moisture content

Low constant oven method (ISTA, 1996, Huda, 2001) will be used to determine the seed moisture. In this method seed will be dried in an oven prescribed at a temperature of $103_{\pm}2^{\circ}$ C for 17± 1 hour. The drying period began at the time of the oven returns to the required temperature. The moisture percentage was measure by using the formula

Moisture %(wet basis) = {Loss in weight (moisture in grams)/ weight of working sample before drying} × 100

3.4.4 Percent of apparently healthy seed and diseased seed

The apparently healthy seed and diseased seed were determined by dry inspection method. The working sample (30gm) of pure seed was separated into the above two grades and the percentage of each grade was determined by counting.

1. **Farmer's seed:** Seeds, which was collected from farmers and used as it, for the quality study.
2. **Apparently healthy seed:** Seeds was sorted from the farmer's seed sample having normal shape, size and color.
3. **Diseased seed:** Seeds which was dark brown to black spotted, discolored, shriveled and suspicious to be infected.
4. **Company seed:** Seeds which was collected from the local seed market as labeled truthfully by the concerned company and used as it for the quality study.

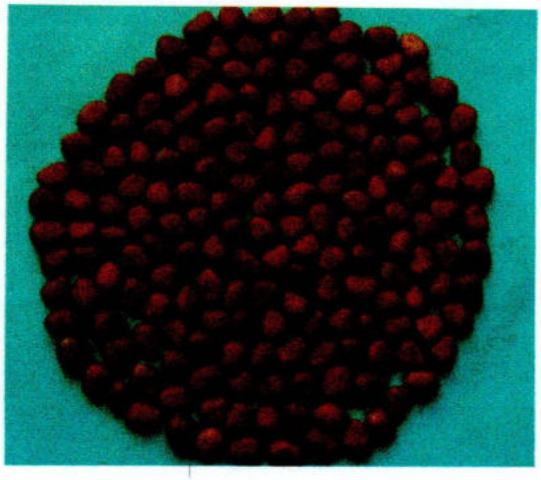

Plate 1: Healthy seed sample of cv. Tasaki Mula

Plate 2: Disease seed sample of cv. Tasaki Mula

Plate 3: Farmer's seed sample of cv. Tasaki Mula

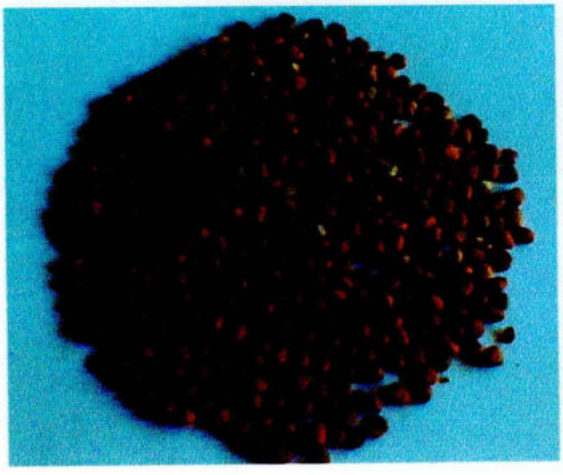

Plate 4: Company seed sample of cv. Tasaki Mula

3.5 GERMINATION TEST

Germination test of the collected seed samples was in sand media. Plastic trays (18"×9") were used for that purpose. Sand used in this method was collected from the worker working for construction of the academic building of HSTU, Dinajpur .100 seeds were sown in sand in each plastic tray in five lines (20 seeds per line). For each sample altogether 400 seeds in four trays were tested for germination. Germination percentage was recorded after 10 days of sowing. Total germinated seedlings, normal seedlings, abnormal seedlings; dead seeds was counted and expressed in percentage.

Normal seedling and abnormal seedling are classified on the following criteria

3.5.1 Normal seedling

Root system: Intact primary root, primary root with slight defects such as discoloured or necrotic spots. Sufficient number of secondary roots present.

Soot system: The mesocotyle intact or slight defects, breaks loose twists.

Coleoptile: The coleoptiles intact, loose twists, emerging through the coleoptiles near the tip, the leaves intact

3.5.2 Abnormal seedling

Root system: The primary root defective, not sufficient or defective secondary roots. Stunted or stubby, broken, split from the tip, constricted, spindly, retarded or missing negative geotropism, glassy, decayed as result of primary infection.

Shoot system: The mesocotyle defective, forming a loop, tightly twisted, decayed as result of primary infection.

The coleoptiles: Deformed, broken, the tip damaged or missing forming a loop or spiral, spilt for more than one third of length from the tip.

3.5.3 Measurement of root and shoot length: Root and shoot length also measured after 10 days of sowing. randomly five plants were selected and each plant were picked up very carefully, then the root and shoot length was measured by scale into cm. Then the average value was recorded.

3.5.4 Vigor index

Vigor index was calculated by the following formula

Vigor index = (Mean of root length + Mean of shoot length) × % of seed germination

3.6 *Alternaria* INFECTED SEED

Four hundred seeds of each sample was plated in Petri dishes lined with three layers of water-soaked blotter papers at the rate of 25 seeds pre 9cm diameter dish, at 20±2°C under near ultra-violent light, in cycles of 12hours light and 12hours darkness for 7days (ISTA,1996).Watering time to time to keep the blotter paper moist. On the 8th day observations was done on whether the seeds were infected by *Alternaria spp.* or not under a stereoscopic microscope (6-50x) and the incidence of *Alternaria spp.* and other organism was recorded. Whenever necessary, the compound microscope was used for confirming identification.

3.7 FIELD EMERGENCE

3.7.1 Land preparation

The soils of the experimental plots were opened with spade in December 2007. Weeds and other rubbishes were removed. Cow dung @5t/ha (Islam, 1995) was mixed thoroughly in the whole experimental field and final ploughing followed by laddering was done during the course of land preparation. The plots then prepared according to the experimental design.

3.7.2 Design and layout

The field experiment was conducted in Randomized Complete Block Design (RCBD).The size of each individual plot was 1m×1m. The space between the plots and blocks was 0.5m and 1m respectively.

3.7.3 Intercultural operation

Two times weeding and two times irrigation have given at 20 days and 30 days after sowing. Plant protecting pesticides were not applied in the field.

3.7.4 Data collection

Data was collected on field emergence, germination failure, post emergence death and plant stand. Data of field emergence and germination failure were collected after 11 and 20 days respectively. The post emergence death and plant stand data were collected after 40 days.

3.8 DATA ANALYSIS

The recorded data on various parameters under the present study were statistically analyzed using MSTAT statistical package programme. Mean differences were judged by Duncan's Multiple Range Test (DMRT). Correlation coefficient was done by SPSS computer program.

CHAPTER 4

RESULTS

RESULTS

4.1 Quality study of farmer's seed sample of radish cv. Tasaki Mula of different upazillas during 2007-2008

In total 40 farmer's seed samples of radish cv. Tasaki Mula of four different locations of growing season 2007-2008 were studied and the findings were presented in Table 2. The purity percentage of seed samples ranged from 93.00% to 99.13%. The highest purity percentage was found 99.13% and the lowest percentage was found 93.00%. The mean value of purity (%) was 96.20%. In case of moisture content it has been recorded from 13.90% to 16.90% moisture. The highest moisture (%) of seed sample was found 16.90% and the lowest moisture (%) was found 13.90%. The mean value of moisture (%) was 14.85%. The 1000-seed weight ranged from 7.78 gm to 15.44 gm. The highest and the lowest 1000-seed weight 15.44gm and 7.78gm respectively were recorded. The mean value of 1000-seed weight was 11.90 gm. In respect of diseased seed the percentage ranged from 22.20 % to 64.00 %. The highest value was recorded 64.00% and the lowest percentage of diseased seed was recorded 22.20%. The average value of diseased seed sample was 35.47%. Incase of healthy seed (%) it was ranged from 36.00% to 77.80%. The highest of 73.80% healthy seed and the lowest of 36.00% healthy seed was recorded. The mean value of healthy seed sample was 64.58%.

Table 2. Quality study of farmer's seed samples of radish cv. Tasaki Mula in 2007-2008.

Seed sample no	Purity (%)	Moisture (%)	1000-Seed weight	Diseased seed (%).	Healthy seed (%).
1	98.17	14.30	14.62	30.60	69.40
2	98.40	14.10	14.06	33.80	66.20
3	97.93	14.80	11.18	36.20	63.80
4	98.40	14.60	15.30	32.20	67.80
5	98.20	14.50	12.40	34.20	65.80
6	98.87	15.00	14.50	32.60	67.40
7	99.13	14.30	15.44	29.00	71.00
8	88.77	14.60	10.58	49.40	51.60
9	98.90	14.40	14.82	30.40	69.60
10	98.83	14.30	15.30	26.20	73.80
11	95.30	14.80	13.64	34.00	66.00
12	96.23	14.30	10.56	22.20	77.80
13	97.53	15.20	10.02	27.00	73.00
14	96.65	15.40	11.86	40.80	59.02
15	96.20	16.90	11.54	27.20	72.80
16	95.70	15.50	11.48	30.60	69.40
17	96.20	15.00	10.94	39.20	60.80
18	96.06	15.50	10.98	26.00	74.00
19	96.13	15.50	13.06	37.60	62.40
20	93.30	15.20	8.02	49.80	51.20
21	96.30	14.50	11.74	24.00	76.00
22	95.10	14.50	13.60	32.40	67.60
23	95.50	14.20	12.60	28.20	71.80
24	96.67	14.80	13.50	33.20	66.80
25	95.60	14.50	10.10	30.00	70.00
26	96.50	15.30	12.10	51.00	49.00
27	95.97	14.90	13.06	33.80	66.20
28	96.27	13.90	10.48	34.40	65.60
29	95.46	14.60	11.70	40.80	59.20
30	94.30	14.60	12.22	32.20	67.80
31	95.57	15.30	11.46	33.80	66.20
32	96.57	15.20	14.00	37.20	62.80
33	95.20	14.80	7.78	29.80	70.20
34	95.47	15.30	8.00	26.40	73.60
35	96.50	15.50	9.26	44.60	55.40
36	95.90	14.90	11.98	46.60	53.40
37	93.00	15.80	9.10	64.00	36.00
38	95.13	14.00	10.92	39.80	60.20
39	96.57	15.10	8.58	47.60	52.40
40	95.46	14.10	13.54	40.00	60.00
$\bar{x}$	**96.20**	**14.85**	**11.90**	**35.47**	**64.58**
δ_{n-1}	**1.88**	**0.59**	**2.10**	**8.65**	**8.57**

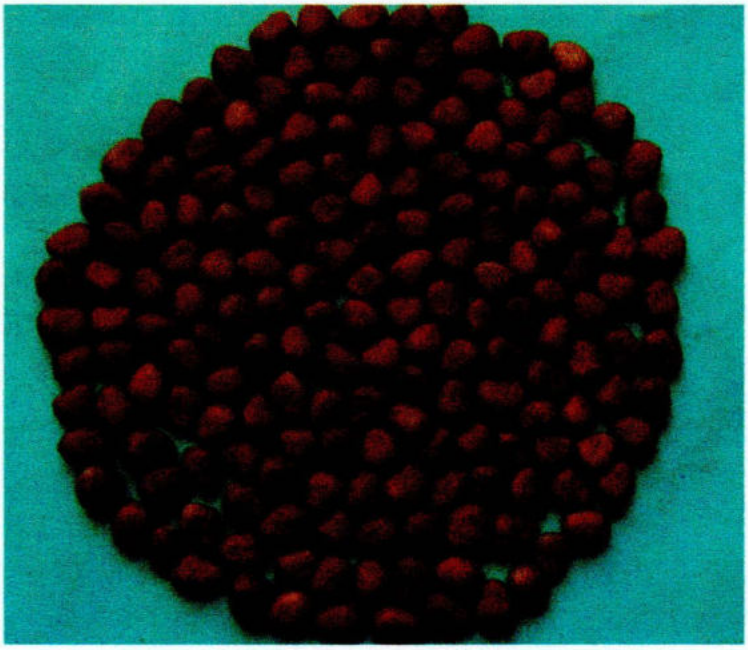

Plate 5: Healthy Seed Sample

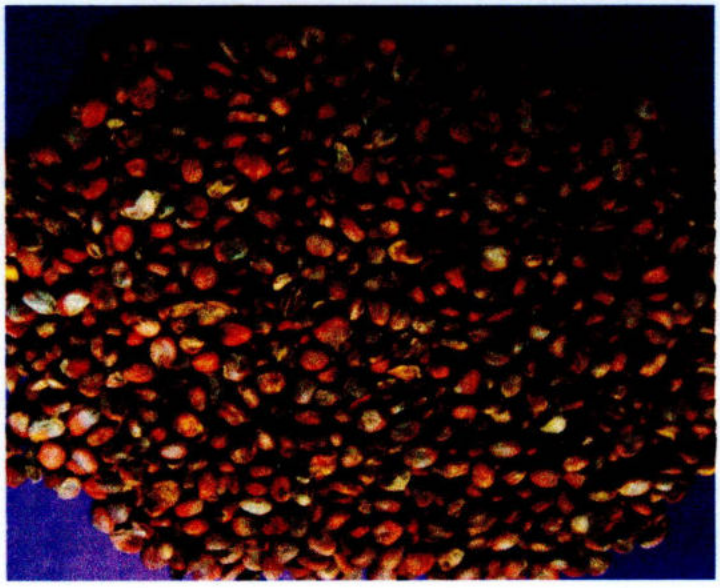

Plate 6: Disease Seed Sample

4.2 Correlation co-efficient of different quality of 40 farmer's seed samples collected from four different upazillas in 2007-2008

The correlation co-efficient study on different parameters of seed quality of 40 farmer's seed samples collected from four different upazillas in 2007-2008 was performed and the results are presented in Table 3. The correlation co-efficient value has been observed that no significant relation exist in case of purity (%) with moisture (%), 1000-seed weight, germination (%), normal seedling (%), abnormal seedling (%),diseased seed (%), healthy seed (%) and *Alternaria* infected seed (%) existents no positive relationship and no significant negative relationship. The correlation co-efficient value incase of moisture (%) with 1000 seed weight, diseased seed (%), apparently healthy seed (%), germination (%), normal seedling (%), abnormal seedling (%) and *Alternaria* infected seed (%) existed no significant relationship. The correlation co-efficient value of 1000 seed weight with germination % (0.68**) and normal seedling % (o.54*) showed significant positive relationship and there is no negative relationship. The correlation co-efficient value incase of diseased seed (%) with germination % (0.59*) , normal seedling % (0.62*) and *Alternaria* infected seed % (0.77**) existent significant positive relationship and the correlation co-efficient value of diseased seed % with apparently healthy seed % (-1.00**) showed significant negative relationship. The correlation co-efficient value of apparently healthy seed (%) with germination (%) and normal seedling (%) showed significant negative relationship. The correlation co-efficient value of germination (%) with normal seedling (%) and *Alternaria* infected seed (%) existent positive significant relationship. The correlation co-efficient value of normal seedling (%) with Alternaria infected seed (%) showed no significant relationship. The correlation co-efficient value of abnormal seedling (%) with Alternaria infected seed (%) was non significant.

Table 3. Correlation of upazilla level farmers seed sample of radish cv Tasaki mula in 2007-2008

Variable	Parameters studied	'r' value
Purity (%)	Moisture	-0.01^{NS}
	1000 seed weight	-0.27^{NS}
	Diseased seed (%)	-0.16^{NS}
	Apparently healthy seed (%)	-0.16^{NS}
	Germination (%)	-0.37^{NS}
	Normal seedling (%)	-0.31^{NS}
	Abnormal seedling (%)	-0.23^{NS}
	Alternaria infected seed (%)	-0.24^{NS}
Seed moisture (%)	1000 seed weight	-0.45^{NS}
	Diseased seed (%)	-0.27^{NS}
	Apparently healthy seed (%)	0.28^{NS}
	Germination (%)	-0.24^{NS}
	Normal seedling (%)	-0.16^{NS}
	Abnormal seedling (%)	-0.15^{NS}
	Alternaria infected seed (%)	-0.12^{NS}
1000 seed weight	Diseased seed (%)	0.01^{NS}
	Apparently healthy seed (%)	0.01^{NS}
	Germination (%)	0.68**
	Normal seedling (%)	0.54*
	Abnormal seedling (%)	0.49^{NS}
	Alternaria infected seed (%)	0.32^{NS}
Diseased seed (%)	Apparently healthy seed (%)	-1.00**
	Germination (%)	0.59*
	Normal seedling (%)	0.62*
	Abnormal seedling (%)	-0.07^{NS}
	Alternaria infected seed (%)	0.77**
Apparently healthy seed (%)	Germination (%)	-0.58*
	Normal seedling (%)	-0.61*
	Abnormal seedling (%)	0.09^{NS}
	Alternaria infected seed (%)	-0.76**
Germination (%)	Normal seedling (%)	0.96**
	Abnormal seedling (%)	0.24^{NS}
	Alternaria infected seed (%)	0.62*
Normal seedling (%)	*Alternaria* infected seed (%)	0.45^{NS}
Abnormal seedling (%)	*Alternaria* infected seed (%)	0.45^{NS}

* and ** means singnificant at 5% and 1% level of significance NS means non significant.

4.3 Quality study of four upazilla seed samples of radish cv. Tasaki Mula in 2007-2008

The quality of different parameters of 40 farmers seed samples collected from four different upazillas in 2007-2008 were done and the results are presented in Table 4. There were no significant relation was found in case of purity (%) where the highest purity of 97.56% recorded in Birginj upazilla's seed samples and the lowest 95.53% was Taragonj upazilla's seed sample. In case of moisture percentage the highest 15.33% was recorded in Kaharol upazilla's sample and the lowest 14.49% in Birgonj upazilla's sample In respect of the 1000-seed weight, the value ranged from 13.82 to 10.46gm. The 1000-seed weight was highest 13.82gm in Birgonj upazilla and the lowest 10.46gm was Taragonj upazilla. The highest 40.98% diseased seed was found in Taragonj upazilla's sample and the lowest 33.44%diseased seed was found in Birgonj upazilla's sample. On the other hand, the highest 66.56% healthy seed was found in Birgonj upazilla's sample and the lowest 59.02% healthy seed was found in Taragonj upazilla's seed sample.

Table 4. Quality study of upazilla level seed samples of radish cv. Tasaki mula in 2007-2008.

Location	Purity %	Moisture (%)	1000 Seed weight	Diseased seed (%)	Healthy seed (%)
Birgonj	97.56 a	14.49 a	13.82 a	33.46 b	66.54 a
Kaharol	95.73 a	15.33 a	11.21 c	33.44 b	66.56 a
Badargonj	95.74 a	14.58 a	12.11 b	33.99 b	66.00 a
Taragonj	95.53 a	15.00 a	10.46 d	40.98 a	59.02 b
LSD	2.53	0.87	0.50	1.82	1.82

**** Data represent the mean of four replications (4×100)**

4.4 Percent germination and vigor index of different upazilla level farmar's seed samples of radish cv. Tasaki Mula in 2007-2008

The quality of 40 seed samples collected from four different upzillas are presented in Table 5. The results revealed that were significant difference of the quality of radish seed among the four upazillas. The highest 77.95% germination was found in Birgonj upazilla's seed samples and the lowest 64.92% germination was recorded in Badargonj upazilla's seed samples. Regarding normal seedling, the highest 56.05% normal seedling was found in Birgonj upazilla seed sample and the lowest 42.08% normal seedling was found in Badargonj upazilla's seed samples. In case of abnormal seedling the highest 22.45% of abnormal seedling was recorded in Badagonj upazilla's seed sample and the lowest 21.05% of abnormal seedling was observed in Kaharol upazilla's seed sample. The highest root length 14.86cm was found in Kaharol upazilla's seed sample and the lowest 11.53cm root length was found in Badargonj upazilla's seed sample. The highest 3.99cm shoot length was found in Birgonj upazilla's seed sample and lowest 3.08cm length of shoot was recorded in Kaharol upazilla's seed samples. In case of vigor index the highest 1220.70 vigor index was recorded in Birgonj upazilla's seed sample and the lowest 917.32 vigor index was observed in Badargonj upazilla's seed sample.

Table 5. Percent germination and vigor index of different upazilla level farmar's seed samples of radish cv. Tasaki Mula in 2007-2008.

Location	Germination (%)	Normal seedling (%)	Abnormal seedling (%)	Root length (cm)	Shoot length (cm)	Vigor index
Birgonj	77.95 a	56.05 a	21.90 b	12.67 b	3.99 a	1220.70 a
Kaharol	67.50 c	46.45 c	21.05 c	14.86 a	3.08 c	1169.78 b
Badargonj	64.92 c	42.08 d	22.45 a	11.53 c	3.49 b	917.32 d
Taragonj	71.70 b	50.38 b	21.33 c	12.91 b	3.11 c	1148.80 c
LSD	3.59	3.72	0.48	0.52	0.38	14.43

**** Data represent the mean of four replications (4×100)**

Plate 7: Germination test of farmer's seed (Sand method)

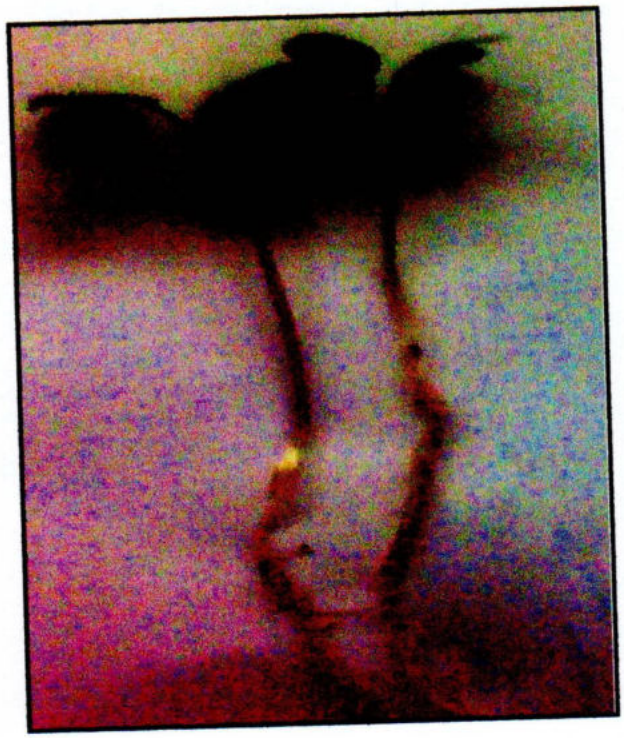

Plate 8: Normal seedling

Plate 9: Abnormal seedling

4.5 Percent of *Alternaria* infected seed of four different upazilla's 40 seed samples of radish cv. Tasaki Mula in 2007-2008

Alternaria infected seed percentage of four different upazilla's 40 seed samples were recorded and presented in Table 6.The highest 25.30% percentage of *Alternaria* infected seed was found in Taragonj upazilla's seed sample and the lowest 22.40% percentage of *Alternaria* infected seed was recorded in Birgonj upazilla's seed sample. The average *Alternaria* infected seed percentage was 23.48%.

Table 6. Percent of *Alternaria* infected seeds of different upazilla level seed samples of radish cv. Tasaki mula in 2007-2008

Location	*Alternaria* infected seed (%)
Birgonj	22.40 b
Kaharol	23.02 b
Badargonj	23.20 b
Taragonj	25.30 a
LSD at 5% level	1.02

**** Data represent the mean of four replications (4×100)**

4.6 Field performance of four different upazillas and 40 farmer's seed samples of radish cv. Tasaki Mula during 2007-2008

The highest 61.40% of field emergence was found in Birgonj upazilla's seed samples and lowest 53.70% percentage of field emergence was recorded in Badargonj upazilla's seed samples. The percentage of germination failure ranged from 38.60% to 46.30%. The highest 46.30% germination failure was observed in Badargonj upazilla's seed samples and the lowest 38.60% of

germination failure was recorded in Birgonj upazilla's seed samples The percentage of post emergence death was ranged from 13.80% to 17.00%. The highest 17.00% of post emergence death was found in Birgonj upazilla's seed samples and the lowest 13.80% of post emergence death was obsereved in Kaharol upazilla's seed samples. The highest 44.40% of plant stand was recorded in Birgonj upazilla's seed samples and the lowest 37.20% of plant stand was recorded in Taragonj upazilla's seed samples.

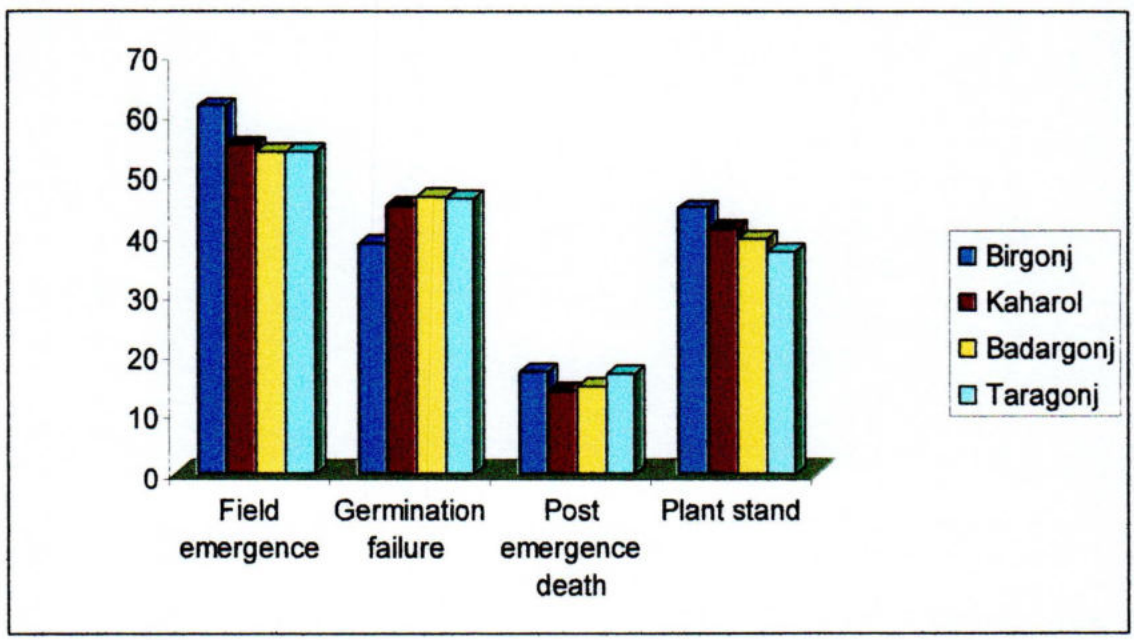

Fig. 1: Field performance of four different upazillas 40 farmer's seed samples of radish cv. Tasaki Mula in 2007-2008

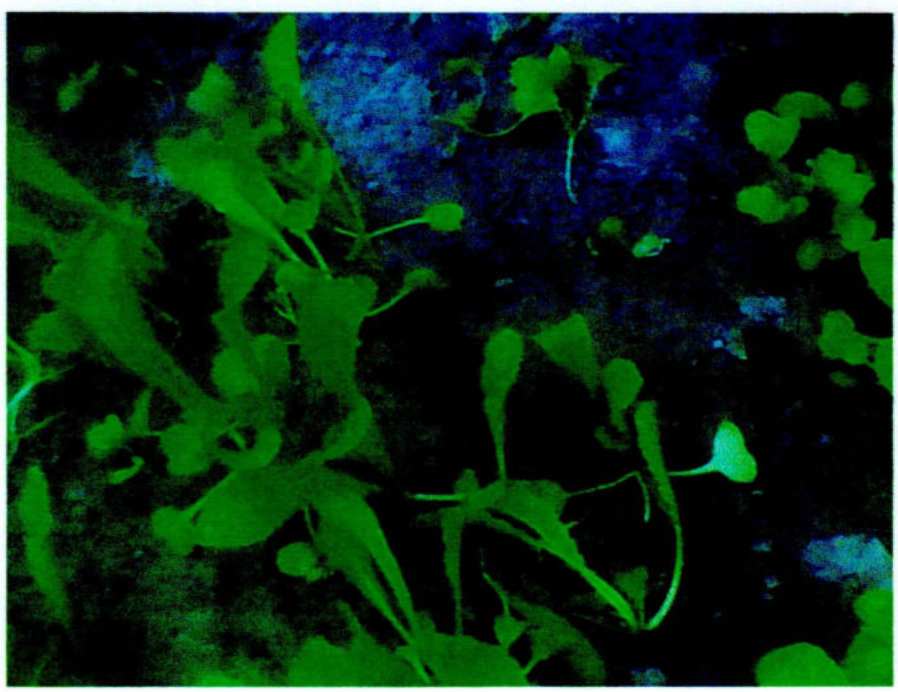

Plate 10: Field emergence of farmer's seed

4.7 Quality study of five different company seed samples of radish cv. Tasaki Mula during 2007-2008

The different quality of five different companies' seed samples was done and the result is presented in the Table 7. There is significant difference among the five companies seed samples regarding purity. The highest 98.80% purity was recorded in Supreme seed company seed samples and the lowest 95.62% purity was found in Molla seed company seed samples. The highest 13.90% moisture percentage was recorded in Metal seed company seed sample and the lowest 12.70% moisture was recorded in Supreme seed company seed sample. The highest 1000-seed weight was observed 13.68gm in Supreme seed company seed sample and the lowest 1000-seed weight was observed 12.22gm in Alamgir seed company seed samples. The highest 39.75% of diseased seed was recorded in Molla seed company seed sample and the lowest 22.07% of diseased seed sample was recorded in Supreme seed company seed sample. The percent of healthy seed of five different companies were significantly difference. The highest 77.93% of healthy seed sample was observed in Supreme seed company seed sample and the lowest 60.25% percentage of healthy seed sample was observed in Molla seed company seed sample.

Table7. Quality study of five Company's seed samples of radish cv. Tasaki Mula in 2007-2008.

Company name	Purity (%)	Moisture (%)	1000 Seed weight	Diseased seed (%)	Healthy Seed (%)
Molla Seed	95.62 c	13.00 ab	12.44 cd	39.75 a	60.25 d
Supreme Seed Co. Ltd.	98.80 a	12.70 b	13.68 a	22.07 d	77.93 a
Lal Tir Seed	96.72 bc	13.57 ab	12.88 bc	33.03 b	66.97 c
Metal Seed	97.67 ab	13.90 a	13.36 ab	23.15 cd	76.85 ab
Alamgir Seed	96.72 bc	13.10 ab	12.22 d	24.20 c	75.80 b
LSD at 5% level	**1.13**	**1.02**	**0.52**	**1.48**	**1.5**

**** Data represent the mean of four replications (4×100)**

4.8 Correlation co-efficient study of five different company seed samples of radish cv. Tasaki mula during 2007-2008

The correlation co-efficient of different parameters of seed quality collecting from five companies' was performed and are presented in Table 8. The correlation co-efficient value showed no significant relation existed in case of purity (%) with moisture (%) and normal seedling (%). Positive significant relation was found incase of purity (%) with 1000 seed weight, apparently healthy seed (%), germination (%), abnormal seedling (%) and *Alternaria* infected seed (%). Negative significant relation was observed in purity (%) with diseased seed (%). The correlation co-efficient value between moisture (%) with 1000 seed weight, diseased seed (%), apparently healthy seed (%), germination (%), normal seedling (%), abnormal seedling (%) and *Alternaria* infected seed (%) were found non significant. In case of 1000 seed weight with apparently healthy seed (%), germination (%), normal seedling (%), abnormal seedling (%) and *Alternaria* infected seed (%) showed positive significant result while negative relationship existed with diseased seed (%). The correlation co-efficient value between diseased seed (%) with apparently healthy seed (%), germination (%), normal seedling (%) and abnormal seedling (%) showed negative significant relationship. The correlation co-efficient value of apparently healthy seed (%) with germination (%), normal seedling (%) and abnormal seedling (%) showed significant positive relationship and there is no significant negative relationship. The correlation co-efficient value of germination (%) with normal seedling (%) and abnormal seedling (%) resulted significant positive relationship. The correlation co-efficient value of abnormal seedling (%) with *Alternaria* infected seed showed significant positively relation. The correlation co-efficient value of *Alternaria* inected seed (%) with other parameters showed positively significant.

Table 8. Correlation co-efficient study of five different company's seed samples of radish cv. Tasaki mula during 2007-2008

Variable	Parameters studied	'r' value
Purity %	Moisture (%)	0.03^{NS}
	1000 seed weight	0.79**
	Diseased seed (%)	-0.70**
	Apparently healthy seed (%)	0.70**
	Germination (%)	0.66**
	Normal seedling (%)	0.17^{NS}
	Abnormal seedling (%)	0.65*
	Alternaria infected seed (%)	0.81**
Moisture (%)	1000 seed weight	0.25^{NS}
	Diseased seed (%)	-0.04^{NS}
	Apparently healthy seed (%)	0.03^{NS}
	Germination (%)	0.25^{NS}
	Normal seedling (%)	0.25^{NS}
	Abnormal seedling (%)	0.17^{NS}
	Alternaria infected seed (%)	-0.12^{NS}
1000 seed weight	Diseased seed (%)	-0.47*
	Apparently healthy seed (%)	0.47*
	Germination (%)	0.53*
	Normal seedling (%)	0.80**
	Abnormal seedling (%)	0.73**
	Alternaria infected seed (%)	0.65**
Diseased seed (%)	Apparently healthy seed (%)	-1.00**
	Germination (%)	-0.88**
	Normal seedling (%)	-0.66**
	Abnormal seedling (%)	-0.55*
	Alternaria infected seed (%)	0.44^{NS}
Apparently healthy seed (%)	Germination (%)	0.87**
	Normal seedling (%)	0.74**
	Abnormal seedling (%)	0.65*
	Alternaria infected seed (%)	0.43^{NS}
Germination (%)	Normal seedling (%)	0.78**
	Abnormal seedling (%)	0.84**
	Alternaria infected seed (%)	0.33^{NS}
Normal seedling (%)	Abnormal seedling (%)	0.32^{NS}
	Alternaria infected seed (%)	-0.11^{NS}
Abnormal seedling (%)	*Alternaria* infected seed (%)	0.60**
Alternaria infected seed (%)	Others	0.60**

* and ** means significant at 5% and 1% level of significant and NS means not significance.

4.9 Percent germination and vigor index of five different Companies seed samples of radish in 2007-2008.

The quality of five different companies' seed sample was observed and the results were presented in Table 9. The quality of five companies' seed samples were significantly difference. The highest 85.00% of germination was found in Supreme Seed Company's seed sample and the lowest 42.50% of germination was found in Molla Seed Company's seed sample. The highest 51.50% of normal seedling was found in Supreme Seed Company's seed sample and the lowest 32.00% of normal seedling was found in Molla Seed Company's seed sample. The highest 34.25% of abnormal seedling was found in Metal Seed Company's seed sample and the lowest 10.50% of abnormal seedling was found in Molla Seed Company's seed sample. The highest 12.85cm root length was found in Supreme seed company seed sample and the lowest 10.06cm root length was found in Molla seed company seed sample. The highest 3.57cm shoot length was found in Supreme seed company seed sample and the lowest 2.45cm shoot length was found in Molla seed company seed sample. The highest 1395.70 vigor index of company seed sample was recorded in Supreme seed company seed sample and the lowest 531.38 vigor index was observed in Molla seed company seed sample.

Table 9. Percent germination and vigor index of five different Companies seed samples of radish in 2007-2008.

Company name	Germination (%)	Normal seedling (%)	Abnormal seedling (%)	Root length (cm)	Shoot length (cm)	Vigor index
Molla Seed	42.50 c	32.00 b	10.50 c	10.06 c	2.45 c	531.68 d
Supreme Seed Co. Ltd.	85.00 a	51.50 a	33.50 a	12.85 a	3.57 a	1395.70 a
Lal Tir Seed	72.00 b	49.50 a	22.50 b	12.04 ab	2.92 b	1077.12 c
Metal Seed	84.75 a	50.50 a	34.25 a	11.45 b	3.14 b	1236.50 b
Alamgir Seed	73.50 b	48.00 a	25.50 b	11.52 b	3.03 b	1069.43 c
LSD at 5% level	**5.33**	**7.60**	**6.78**	**0.87**	**0.31**	**20.18**

**** Data represent the mean of four replications (4×100)**

Plate 11: Germination of company seed on sand.

4.10 Percent of *Alternaria* infected seed of five company seed samples of radish cv. Tasaki Mula in 2007-2008

The health status of five different companies' seed samples was studied and the results were presented in the Table 10. The highest 22.50% of *Alternaria* infected seed was recorded in Molla seed company seed sample and the lowest 17.25% percentage of *Alternaria* infected seed was observed in Supreme seed company seed sample which was same to Lal teer seed, Metal seed and Alamgir seed samples.

Table 10: Percent of *Alternaria* infected seed of five company seed samples of radish cv. Tasaki mula in 2007-2008

Name of the company	Alternaria infected seed (%)
Molla seed company	**22.50 a**
Supreme seed company	**17.25 b**
Lal teer seed	**18.25 b**
Metal seed	**18.00 b**
Alamgir seed	**18.75 b**
LSD at 5% level	**2.42**

**** Data represent the mean of four replications (4×100)**

4.11 Field performance of five company's seed samples cv. Tasaki Mula during 2007-2008

In field study of five different companies seed samples were found significantly different regarding percent field emergence, germination failure, post emergence death and plant stand. The highest 73.00% of field emergence was found in Supreme seed company seed company seed sample and the lowest 50.50% of field emergence was found in Molla seed company seed sample. The highest 45.50% of germination failure was found in Molla seed company seed sample and the lowest 27.00% of germination failure was found in Supreme seed company seed sample. The highest 17% post emergence death was found in Molla seed company seed sample and the lowest 13% post emergence death was found in Metal seed company seed sample. The highest 58.00% of plant was found in Supreme seed company seed sample and the lowest 33.50% of plant was found in Molla seed company seed sample.

Table 11. Field performance of five Companies' seed samples of radish cv. Tasaki Mula in 2007-2008.

Company name	Field emergence	Germination failure	Post emergence death	Plant stand
Molla Seed	50.50 c	49.50 a	17.00 a	33.50 c
Supreme Seed Co. Ltd.	73.00 a	27.00 c	15.00 ab	58.00 a
Lal Tir Seed	63.25 b	36.75 b	14.75 ab	48.50 b
Metal Seed	70.75 a	29.25 c	13.00 b	57.75 a
Alamgir Seed	70.75 a	29.25 c	16.00 ab	54.50 a
LSD at 5% level	3.51	3.51	3.126	3.70

**** Data represent the mean of four replications (4×100)**

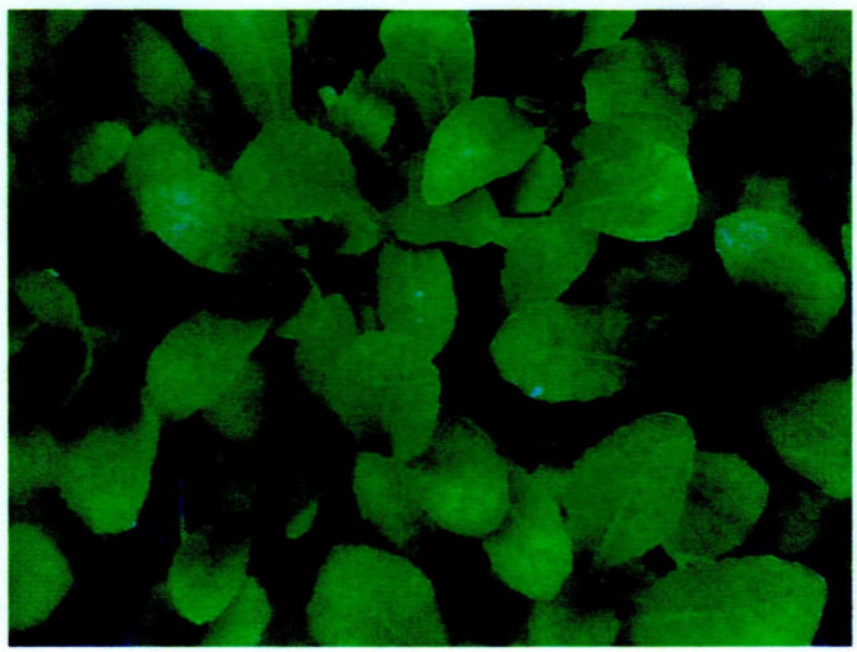

Plate 12: Plant stand of company seed sample

CHAPTER 5

DISCUSSION

DISCUSSION

The radish has a number of diseases of which Alternaria blight caused by *Alternaria brassicae* and *Alternaria brassicicola* is a serious threat of seed crop. This disease is one of the most devastating which causes heavy yield losses and major constraint for high quality radish seed production in Bangladesh (Mondal *et al.*, 1989). The experiment was conducted to study the quality of farmer's seed samples of four different upzillas (Birgonj, Kaharol, Taragonj and Badargonj) and five different companies seed samples (Molla Seed Company, Supreme Seed Company, Metal Seed Company, Lal teer Seed Company and Alamgir Seed Company).

To get the practical information regarding the seed quality of radish, the farmer's seed samples and some important company seed samples were collected and investigated. The present research works have been carried out on seed quality of 40 farmers' seed samples and five companies' seed samples of radish cv. Tasaki mula. The quality of farmer's seed samples of radish cv. Tasaki mula was found to have higher level of variations towards purity, moisture contents, 1000-seed weight, normal seedling, abnormal seedling and all aspects of healthy seed. Farmer's seed having different qualities showed different performance in respect of tested parameters as concurred by Huda (2001). He opined that the quality of farmer's seed is unknown as no testing in respect of quality is made.

All the companies' seed samples were found to be infected by *Alternaria*, which is supported by Humperson-Jones (1985) and Shresttha *et al.* (1998).In the pathological view point, all the seed samples collected from farmer's house and companies seeds from local seed market were found infected with

Alternaria. There no seed samples were found free from infection. These results showed that all the seed samples of Dinajpur-Rangpur region were infected by *Alternaria* species. Percent samples infection of various brassicaceae was demonstrated earlier by several researchers. Neergard (1940) reported 90% of commercial available seed. Hampherson-Jones (1985) reported 88% of seed lot produced in UK and Shresttha *et al.* (1998) reported 89-99% of seed lots produced in Nepal of various brassicaceae seeds were infected by *Alternaria* species. Most of the susceptible vegetables of brassicaceae are grown in Bangladesh at the same growing time of radish. These crop act as collateral hosts and support primary infection for radish. Such a risk of gross infection of the crops has been observed in England (Humpherson-Jones 1994.).

Valkonen and Koponen (1990) stated that *A. brassicae* and *A. brassicicola* are seedbrone pathogen of radish. They reported that this pathogen reduces the germination resulting the damping-off or stunted seedling. The findings of this study have clearly pointed out the health and quality of farmer's produced radish seed of four upzillas (Birgonj, Kaharol, Taragonj and Badargonj) of Rangpur - Dinajpur districts and five companies seed (Molla seed company, Supreme seed company, Lal teer seed company, Metal seed company and Alamgir seed company). Throughout the study period it has been found that farmer's seed were not good quality in terms of all parameters studied. Therefore, the findings of the present study may be concluded that, the quality of farmer's seed of radish in these region were inferior quality, where the companies seed were comparatively higher quality regarding all the tested parameters, viz. purity, moisture content, 1000-seed weight, germination (%), diseased seed (%), apparently healthy seed (%), normal seedling (%), abnormal seedling (%) and *Alternaria* infected seed (%).

However, findings of this study suggested for extensive further study in this discipline.

CHAPTER 6

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

Radish (*Raphanus sativus* L.) belonging to the family Cruciferae is the third most important vegetable crop in Bangladesh. The high yielding tropical annual type Tasaki Mula developed by Bangladesh Agricultural Research Institute was used in this study. The Rangpur-Dinajpur is the most suitable for quality seed production in this country. Therefore, the present studies have been carried in this region. In total 40 farmer's seed samples and five companies seed samples were collected from four upzilla's viz. Birgonj, Kaharol, Badargonj and Taragonj and their quality status were studied. Alternaria blight caused by *Alternaria brassicae* and *Alternaria brassicicola* are the most devastating disease which causes heavy yield losses and major constraint for quality seed production in Bangladesh.

The laboratory and field study were conducted in the farm and laboratory of Department of Plant Pathology in Hajee Mohammad Danish Science and Technology University, Dinajpur during the period of November 2007 to May 2008. The data were collected on purity(%), 1000 seed weight, apparently healthy seed (%), apparently diseased seed (%), moisture content(%), germination (%), normal seedling (%), abnormal seedling (%), root length (cm), shoot length (cm), field emergence and *Alternaria* infected seed (%).

The purity percentage of all farmers' seed samples were almost similar 95-98%. Moisture percentage of seed ranged from 14-16% in all upazilla level. 1000-seed weight was the highest 13.82gm of Birgonj upazilla's seed and the lowest 1000-seed weight 10.46% was found in Taragonj upazilla's seed. The

highest 40.98% of apparently diseased seed was recorded in Taragonj upazilla's seed and the lowest 33.44% of apparently diseased seed was found in Birgonj upazilla's seed. Apparently healthy seed 66.56% was the highest in Birgonj upzilla's seed and the lowest 59.02% was observed in Taragonj upzilla seed. Germination 77.95% was highest in Birgonj upazilla's seed and lowest 64.92% of germination was recorded in Badargonj upazilla's seed. The highest 1220.70 and lowest 917.32 vigor index was observed in Birgonj upazilla's seed sample and Badargonj upazilla's seed sample respectively. *Alternaria* infected seed was highest 25.30% in Taragonj upazilla's seed and lowest 22.40% in Birgonj upazilla's seed but, they were statistically similar. Field emergence of all upazilla was statistically similar but, highest 61.40% in Birgonj upazilla's seed and the lowest 53.70% in Badargonj upazilla's seed Percent plant stand of all upazilla's seed samples were statistically similar but, the highest 44.40% plant stand was found in Birgonj upazilla's seed and the lowest 37.20% plant stand was found in Taragonj upazilla's seed.

In company seed the highest 98.80% purity was found in the Supreme seed company seed and the lowest 95.62% of purity was found in Molla seed company seed. Moisture percentage was highest 13.90% in Metal seed company seed and the lowest 12.70% of moisture was found in Supreme seed company seed. 1000-seed weight was highest 13.68gm in Supreme seed company seed and lowest 12.22gm in Alamgir seed company seed. Highest 39.75% percentage of diseased seed was recorded in Molla seed company seed and lowest 22.07% of diseased seed was recorded in Supreme seed company seed. Healthy seed percentage was highest 77.93% in Supreme seed company seed and the lowest 60.25% of healthy seed was found in Molla seed company seed. Germination percentage was highest 85.00% in Supreme seed company seed and lowest 42.50% percentage of germination was observed in Molla seed company seed. The highest vigor index 1395.70 was

found in Supreme seed company seed and the lowest was 531.68 recorded in Molla seed company seed. *Alternaria* infected seed was observed highest 22.50% in Molla seed company seed and lowest 17.25% in Supreme seed company seed. Field emergence was highest 73.00% in Supreme seed company seed and lowest50.50% in Molla seed company seed. Plant stand was highest 58.00% in Supreme seed company seed and lowest 33.50% in Molla seed company seed. Finally it may be concluded that all the seed samples collected from farmer's level and company level were comparatively inferior as studied but, the company seed were better than farmers seed samples in all aspect of seed quality.

Present research work has clearly pointed out that,

1. All the farmer's seed samples collected from farmer's house were comparatively inferior in quality.
2. The company's seed were found comparatively higher qualitythan farmer's seed samples.

Therefore, company's seed may be suggested for production of quality seed of radish cv. Tasaki mula.

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APPENDIX

Appendix: Weather data for growing season of wheat, 2007-2008

Month		Sun shine (hr)	Humidity (%)	Temp. (°C)		Evaporation (mm)	Wind-run 2mt-ht (km/hr)	Total rainfall (mm)
				Mini	Max.			
November	1-15	8.7	93.6	18.9	31	3.0	18.7	3
	16-30	8.5	90.7	15.2	29.2	3.1	25.4	-
	Avg.	8.5	92.2	17.1	30.1	3.1	22.1	-
December	1-15	6.4	92.3	12.5	26.5	2.0	16.9	-
	16-31	4.4	91.6	10.1	24.6	1.5	13.2	-
	Avg.	5.4	91.9	11.3	25.6	1.8	15.1	-
January	1-15	5.6	89.0	10.4	25.6	1.4	15.4	-
	16-31	2.3	89.3	11.7	22.1	1.9	40.7	41
	Avg.	4.0	89.2	11.0	23.9	1.7	28.1	-
February	1-15	5.6	89.9	10.0	22.9	2.0	19.9	1
	16-29	7.0	89.1	12.2	27.7	2.4	23.1	4
	Avg.	6.3	89.5	11.1	25.3	2.2	21.5	-
March	1-15	3.3	88.0	16.7	29.5	2.7	31.8	24.5
	16-31	2.9	88.3	12.3	31.4	4.6	40.9	.5
	Avg.	3.1	88.2	14.5	30.5	3.7	36.4	Total=74mm
April	1-15	7.4	90.1	11.2	32.4	4.7	42.8	19

Total Rf = 93mm

Source: Wheat Research centre, Dinajpur.