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Study on Seed Quality and Performance of Some Mungbean Varieties in Pakistan

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ABSTRACT

The experiment was conducted at Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan during the period of Jan. to Feb. 2012. The seeds of three varieties of mungbean (NIAB-2006, AZRI-2006 and Chakwal M-6) were collected during 2010-11 from National Institute of Agriculture and Biology, Faisalabad (NIAB); Arid Zone Research Institute, Bhakkar (AZARI) and Barani Agriculture Research Institute, Chakwal (BARI) to assess the quality status of seeds. Purity percentage and germination percentage of the seeds of all varieties were higher than the national seed standard. The minimum purity was 99.33%, germination was 88.11% and moisture content of all seed samples was lower than the acceptable seed standard. The minimum moisture content of seed samples was 8.33% and the highest 8.75%. The highest 1000 seed weight differed from 56.58 to 63.33 g among the mungbean varieties. In seed health test, nine species of fungi under six genera were recorded from mungbean seed samples. They were *Alternaria brassicicola*, *A. brassicae*, *Aspergillus flavus*, *A. niger*, *A. Fumigatus*, *Ascochyta rabiei*, *Fusarium* sp, *Macrophomina phaseolina* and *Rhizopus* sp. Among them *Aspergillus* spp (*A. flavus* and *A. niger*) were the most predominant fungi which was followed by *Fusarium* sp.
Key words: seed quality, performance, mungbean variety, mycoflora

INTRODUCTION

Mungbean (*Vigna radiata* (L.) Wilczek) is an important wide spreading, herbaceous, annual, self-pollinated legume pulse crop under the family Leguminosae. Mungbean (*Vigna radiata* (L.) Wilczek) are the major Rabi (October to May) and Kharif seasons pulse crops respectively. Mungbean is also cultivated in the summer season. Mostly it is grown as a catch crop summer or autumn season. Its major concentration is found in the districts of Jhelem, Chakwal, Rawalpindi, Sargodha, Mianwali, and Bhakkar etc. It can fix atmospheric nitrogen through symbiotic relationship with rhizobium bacteria and improves the soil fertility (Yadav *et al.* 1994). It is an excellent source of proteins and minerals for most of the peoples of Pakistan. Mungbean has been considered as a "poor men's protein" (Mian 1976). Apart from 26% protein, it also contains 51% carbohydrate, 10% moisture, 4% minerals and 3% vitamins (Khan 1981). The average yield of mungbean is very low (763.50 kg $^{-ha}$) as compared to its potential yield of 2 to 4 ton $^{-ha}$ (Ramakrishna *et al.* 2000). There are various factors which are responsible for low yield of mungbean in our country of which use of poor quality seed and disease infestation in the field are the most important (Bakr and Rahman, 1998). Poor seed quality like low germination capacity affects the yield of mungbean. Seeds with low germination capacity may capable to emergence to some degree but healthy plants can not be ensured. Purity percentage and moisture content of seed also affect on yield of mungbean. Impure seeds create many hazards in the field like suboptimal crop population and enhancement of weed infestation. Similarly, seed moisture content above safe life is highly dangerous as it is accelerates the death of seed at much high rate than that of other factors related to seed deterioration. Seeds are common carrier of plant pathogens, which act as the primary source of inocula of many diseases (Rahman and Mia, 1998). Contaminated seeds can often result in poor germination and poor seedling vigor, resulting in an un-healthy crop. Healthy seed is the foundation of healthy plant; a necessary condition for good yields (Diaz *et al*. 1998). Field fungus associated with seeds cause deterioration of seed quality, affect viability and reduces germination (Srivastava and Gupta, 1981). The infected seeds fail to germinate or seedlings and plants developed in the field from infected seeds may escape early infection but may often be infected at the later stage of growth. Besides, pathogens can spread over a long distance and uninfected field may be infected by the seeds in which different pathogens are present (Fakir *et al*. 2001). A large number of mycoflora was reported to be associated with the mungbean seeds. *Alternaria* sp, *Fusarium oxysporum*, *Fusarium solani*, *Fusarium equiseti*, *Myrothecium roridum*, *Drechslera* spp, *Aspergillus flavus*, *A. niger* and *Macrophomina phaseolina* were found in germinating seed and seedling of mungbean (Bakr and Rahaman, 2001). At present, fifteen mungbean varieties are available in Bangladesh. However, information relating seed quality and performance of those varieties is not well documented. Therefore the study was thus undertaken to evaluate the quality status of seeds of different mungbean varieties commonly available in Pakistan.

MATERIALS AND METHODS

The experiment was conducted at Institute of Agricultural Sciences, University of the Punjab, Lahore Pakistan during the period of Jan. to Feb. 2012. The seeds of three varieties of mungbean (NIAB-2006, AZRI-2006 and Chakwal M-6) were collected during 2010-11 from National Institute of Agriculture and Biology, Faisalabad

(NIAB); Arid Zone Research Institute, Bhakkar (AZARI) and Barani Agriculture Research Institute, Chakwal (BARI) to assess the quality status of seeds. One kilogram seeds of each variety was collected and kept in air tight polyethylene bag. They were brought to the laboratory and preserved in a refrigerator at 4 °C. Quality attributes and health status of the seeds were determined by taking samples from each variety of the seeds. For quality tests such as purity test, moisture test, germination test, 1000-seed weight and health status were studied.

Purity test

After mixing 2-3 times, 400 g of mungbean seed was taken from each variety for purity test. These working samples were separated into three components such as pure seed, other seed and inert matter.

Moisture content

Moisture content was determined by oven dry method following low constant temperature oven method (ISTA 2006 a). Three independent working samples of seeds were drawn from each sub samples. Five grams of seed of each working sample were dried in an oven at 103±2C for seventeen hours. Percentage of moisture content was calculated using following formula:

$$\% \text{ Moisture Content} = \frac{M_2 - M_3}{M_2 - M_1}$$

Where,

M_1 = Weight in grams of the container,

M_2 = Weight in grams of the container, its cover and mungbean seed before drying, and

M_3 = Weight in grams of the container, cover and mungbean seed after drying.

Thousand seeds weight

To determine 1000 seeds weight, sub samples were drawn from each seed samples. For that purpose 3000 pure seeds were sorted out. They were divided into three working samples. Weight of 1000 seeds was measured taking 100 seeds at a time. Average weight of three working samples were computed and recorded as 1000-seed weight (Ariyaratne 1998).

Germination test

Four (4) hundred pure seeds were randomly taken from each sample for germination test. Three layered moistened blotting paper was taken on germination containers. Hundred (100) seeds were placed on each container and kept at 25C temperature. First count and final count were taken at 5 days and 8 days, respectively. Only the normal seedlings were counted for germination percentage. Mungbean seed species is belonged to the seedling evaluation group 2.1.2.2 (ISTA 2006b). It is dicotyledon with epigeal germination, elongated epicotyl and secondary roots are taken into account if primary roots are defective. .

Vigor index

Vigor index (VI) was calculated (Anon. 1983) according to the following formula:

$$VI = \frac{\text{No. of germinated seeds at first count}}{\text{Days of first count}} + \frac{\text{No. of germinated seeds at final count}}{\text{Days of final count}}$$

Mean germination time

Mean germination time (MGI) was calculated according to the equation of Ellis and Roberts (1981):

$$MGI = \frac{\Sigma D n}{\Sigma n}$$

Where n is the number of seeds germinated on day D and D is the number of days counted from the beginning of germination.

Seed health test

Health status of seeds was determined by blotter method (ISTA 1966). A working sample of 400 seeds was randomly drawn from each sample. The seeds were placed on three layered moistened blotter paper in glass petridish (9 cm) at the rate of 25 seeds per petridish. The petridishes were incubated at 25±2C under natural light and darkness cycle for seven days. Different fungi grown on the incubated seeds were recorded by using stereo binocular microscope following standard keys. In case of confusion, temporary mounts were prepared and

examined under compound microscope for identification of the associated fungi. Prevalence of fungi was expressed in percentage based on total number of seeds plated. Data were analyzed statistically by using MSTAT-C software for proper interpretation. The mean values were compared according to Duncan Multiple Range Test (DMRT) at 5% level of significance.

RESULTS AND DISCUSSION

Results of the quality tests of mungbean varieties seed collected from National Institute of Agriculture and Biology, Faisalabad (NIAB); Arid Zone Research Institute, Bhakkar (AZARI) and Barani Agriculture Research Institute, Chakwal (BARI) are presented below.

Purity

Among three seeds samples, the range of purity was 99.30% to 99.65%. All the samples had higher purity percentage than the recommended standard (95%) of National Seed Standards (NSS) of Pakistan (Table 1). The highest average purity percent of 99.65% was obtained from NIAB mung-2006 followed by AZRI mung-2006 (99.55%) and Chakwal M-6 gave the lowest purity (99.30%).

Moisture content

Moisture content of seed samples of different varieties differed significantly. The highest moisture content (8.78%) was recorded in Chakwal M-6 which was statistically identical with AZRI mung-2006 (8.75%). Significantly the lowest moisture content was recorded from NIAB mung-2006 (8.33%) (Table1). As per recommendation of National Seed Standards (NSS) of Pakistan moisture content of mungbean seeds should be less than 10.00%. Results of the present investigation showed that moisture content of all the seed samples were lower than the recommended standard.

Thousand seed weight

1000-seed weight of three mungbean seed samples, varied from 56.58 to 63.33g (Table 1). Significantly the highest 1000-seed weight of 63.33 g was obtained from NIAB mung-2006 which was followed by Chakwal M-6 (60.63g). and AZRI mung-2006 (56.58g).

Germination capacity

The germination percentage of three seed samples of mungbean varieties varied from 89.11% to 100% (Table 2). Highest germination of 100% was found in NIAB mung-2006 and AZRI mung-2006 which were statistically similar with NIAB mung-2006 (96.33%). The lowest germination percentage was obtained from Chakwal M-6 (89.11%). The results reflected that different mungbean varieties seeds saved by different Research Institute had the higher germination capacity than the recommended by National Seed Standards (NSS) of Pakistan (80%).

Vigor index (VI)

The vigor index of three seed samples of mungbean varieties varied from 75.68 to 92.12 (Table 2). Significantly the highest vigor index of 92.12 was recorded in NIAB mung-2006 which was statistically identical with AZRI mung-2006 (85.28). Significantly the lowest vigor index was recorded from Chakwal M-6 (75.68).

Mean germination time (MGT)

The mean germination time studied on mungbean varieties seeds are presented in Table-2 reflected that mean germination time was differed significantly. Significantly the highest mean germination time of 1.97 days was recorded in Chakwal M-6. NIAB mung-2006 gave significantly the lowest mean germination time (1.18 days). Result revealed that different research institute preserved the seed samples of different mungbean varieties at optimum storage condition so therefore; seed qualities of the entire seed sample were above the recommended seed standard by National Seed Standards (NSS) of Pakistan.

Table 1. Quality attributes of three mungbean varieties seed samples collected from NIAB, AZRI and BARI
Values a column with same letter(s) are not statistically different at 0.05 level of significance by DMRT

Treatments	Quality attributes					
	Purity (%)	Moisture content (%)	Thousand seed weight (gm)	Germination Capacity (%)	Vigor index (VI)	Germination on time (MGT) (days)
NIAB mung-2006	99.65	8.33ab	63.33a	100a	92.12a	1.18ab
AZRI mung-2006	99.55	8.75a	56.58ab	96.33a	85.28b	1.66b
Chakwal M-6	99.33	8.75a	60.63b	89.11b	75.68ab	1.97a
CV%	1.28	2.19	6.09	3.02	8.30	8.66

NS indicates not significant

Seed Health status

Altogether eight species of fungi under six genera were recorded from three seed samples of mungbean varieties collected from different Research Institute (Table 2). They were *Alternaria* spp. (*A. brassicicola and A. brassicae*), *Aspergillus* spp. (*A. fumigates, A. flavus* and *A. niger*), *Ascochyta rabiei*, *Fusarium* sp., *Macrophomina phaseolina* and *Rhizopus* sp. Among these fungi *Aspergillus* spp. (*A. fumigates, A. flavus* and *A. niger*) was found to be the most prevalent fungi ranging from 8.84% to 22.93% which was followed by *Fusarium* sp. ranging from 14.36% to 3.33%. The highest *Aspergillus* spp. were found in AZRI mung-2006 (22.93%), followed by Chakwal M-6 (21.19%). The lowest *Aspergillus* spp. was found in NIAB MUNG-2006 (8.84%). In case of *Fusarium* sp. the highest *Fusarium* sp. were found in AZRI mung-2006 (14.36%) which was statistically similar with Chakwal mung-2006 (13.39%). The statistically lower *Fusarium* sp. was found in NIAB mung-2006 (3.33%). In case of *Alternaria* spp. the highest number was reached in AZRI mung-2006 (3.02%) and their was no record found in NIAB mung-2006. The highest percentage of *Ascochyta rabiei* (6.70%), *Macrophomina phaseolina* (3.61%), and *Rhizopus* sp. (7.21%) was recorded in Chakwal M-6. The lowest percentage of *Ascochyta rabiei* (2.58%) and *Rhizopus* sp. (1.55%) were found in NIAB mung-2006 while *Macrophomina phaseolina* was not recorded in this varity. The occurrence of these fungi in mungbean seed has been reported by many other workers (Bakr *et al.* 2001, Fakir *et al.* 2001, Barua 2004). *Aspergillus flavus, A. niger, Fusarium* spp. (*F. oxysporum, F. moniliforme, F. semitectum), Penicillium* spp. and *M. phaseolina* were reported seed-borne in mungbean (Joyjit *et al.* 2007).

Table 2. Prevalence of different fungi in seed samples of three mungbean varieties

Treatment	% Infection							
	Aspergillus niger	***Aspergillus fumigatus***	***Aspergillus flavus***	***Alternaria sp***	***Ascochyta rabiei***	***Fusarium sp.***	***Macrophomina phaseolina***	***Rhizopus sp.***
NIAB mung-2006	2.41ab	3.61c	2.82c	0.00c	2.58c	3.33ab	0.00c	1.55ab
AZRI mung-2006	12.24a	7.11b	3.58b	3.02a	5.15b	14.36a	2.06b	5.15b
Chakwal M-6	6.19b	8.82a	6.18a	2.06b	6.70a	13.39b	3.61a	7.21a
CV%	5.29	5.06	7.43	6.03	7.02	5.51	6.37	6.01

Values a column with same letter(s) are not statistically different at 0.05 level of significance by DMRT
**Alternaria* spp. includes *Alternaria brassicae* and *Alternaria brassicola*

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