__Original Research Article__

Understanding Morpho-Physiological Traits Conveying Preharvest Sprouting Tolerance in Mungbean Varieties

Abstract

Due to the absence of fresh seed dormancy (FSD) in mung bean seeds makes them susceptible to pre-harvest sprouting (PHS). Mung bean yield has been proved to be 60–70% reduced in response to PHS, an abiotic stress. By understanding this problem present study was carried out at at experimental field, Department of Agricultural Botany (Plant Physiology), PGI, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during kharif season 2012-13. The experiment entitled "Insights from morpho-physiological traits imparting tolerance for preharvest sprouting of munbean genotypes". The design of experiment is RBD in three replications with sixteen genotypes. It was observed that on the basis of morpho-physiological traits viz., high hard seed %, pod pubescence, lower germination in pod and seed , less seed and pod moisture genotype AKM-9801, AKM-9907,BM-2002-1 and AKM-10-05, genotypes were found to be tolerant to preharvest sprouting. And more interesting fact is the seed yield per hector found efficient in AKM-8802 and AKM-9907. So it was found that AKM 9907 is best suitable variety of mungbean in kharif season to prevent crop form whether damage and improve yield also.

Key words: Mungbean, Preharvest sprouting, yield

Introduction

After cereals, pulses are the second most important food in the Indian diet and play a major role. They are abundant in calcium, phosphorus, vitamins, and minerals in addition to protein. However, pulse crops generally produce less than cereal crops and exhibit yield instability. Likewise Mung bean (*Vigna radiata* L.) is one of the most important legume crop belong to family Fabaceae. In India, mungbean is mainly grown as a rainy season crop and is generally caught in rains at maturity and greatly due to preharvest sprouting due to a lack of fresh seed dormancy (FSD). PHS is an abiotic stress that has been shown to reduce mungbean yield by 60-70%. Pre-harvest sprouting (PHS) means wheather damage is a condition caused by ecological factors, particularly in humid conditions, that result in significant yield losses in black gram. Preventing pre-harvest sprouting or weather damage is important in mungbean crops because it has been identified as a critical constraint that reduces crop yield potential. There are two mechanisms to protect the crop from weather damage one is avoidance and second is tolerance, but avoidance is not possible for a rainy season crop, so it is essential to develop resistance/tolerance in crop by understanding morpho physiological traits against preharvest sprouting. Keeping in the view of above facts, the study entitled "Insights from morpho-physiological traits imparting tolerance for preharvest sprouting of mungbean genotypes" was conducted along with the objective to determine the best suitable genotypes tolerance against weather damage or preharvest sprouting.

Materials and methods

The experiment entitled **"Insights from morpho-physiological traits imparting tolerance for preharvest sprouting of munbean genotypes"** was plotted in RBD in three replications with sixteen genotypes. For the current study period, Kharif 2012, the rainfall (mm), mean maximum and minimum temperature (0c), and humidity (%) per day was given from the Meteorological Observatory Department of Agronomy, Dr. PDKV., Akola. Total 602.1 mm rainfall was received from 1st June to 30 Sept. 2012. Experiment was designed in the design Randomized Block Design (RBD) with sixteen genotypes and three replications. The genotypes include AKM-8802, PKV-GREEN GOLD, PKVAKM-4, BM-2002-1, BM-2003-2, KOPERGAON, AKM-9907, AKM-09-2, AKM-10-16, AKM-10-21, AKM-0603, AKM-10-05, AKM-10-13, AKM-10-24, AKM-8803 and AKM-9801. The observation was recorded morpho-physiological observation and yield and its attributes to find out suitable genotype against weather damage. The data of plant height was taken at harvest when yield attributes like number of pods per plant, 100 seed rate, hard seed percentage, seed luster, pod orientation, pod wall thickness, pod pubescence, pod length, pod break was taken along with yield per plot and then computed into yield per hector.

$$\boldsymbol{Hard\ seed}\ (\mathbf{100}\%) = \frac{\boldsymbol{Hard\ seeds}}{\boldsymbol{Total\ seed\ put\ for\ germination}} \times \mathbf{100}$$

Result and discussion

The data to find out the best suitable genotype tolerance to preharvest sprouting of mung was recorded and furnished in table no. 1, figure no. 1 and figure no.2.

Morphological attributes

Plant height

A significant result of plant height was recorded at 60 days. It was observed that BM-2003-2 (82.37 cm) has recorded highest plant height followed by AKM-0603 (75 cm) and AKM-8802 (73.51 cm). A tall genotype having more number of long pods, with high pod wall, small beak, epicuticlar wax and hard seed coat are suitable for developing resistance to pre harvest sprouting (Cheralu, 1995) [3].

Hard Seed (%)

Hard seed percentages were highest in genotype AKM-9801 (61.33%), which was followed by AKM-9907 (59.67%), BM-2002-1 (53.33%), and AKM-10-05 (45.67%), all of which were significantly higher than the mean (22.17). Mung beans with hard seeds have an impermeable seed coat composed of suberin layers and absence of pores in the epidermis. Harder-seeded mung bean genotypes survive weathering superior in the field. Rolston (1978) [12], Imrie (1983) [7], Davidson (1985) [4], Lwan (1987) [9], and Anonomyous (2011) [1] discovered similar outcomes.

Figure no. 1 Data of No. of pod per plant, pod pubesence, seed hardiness and grain weight

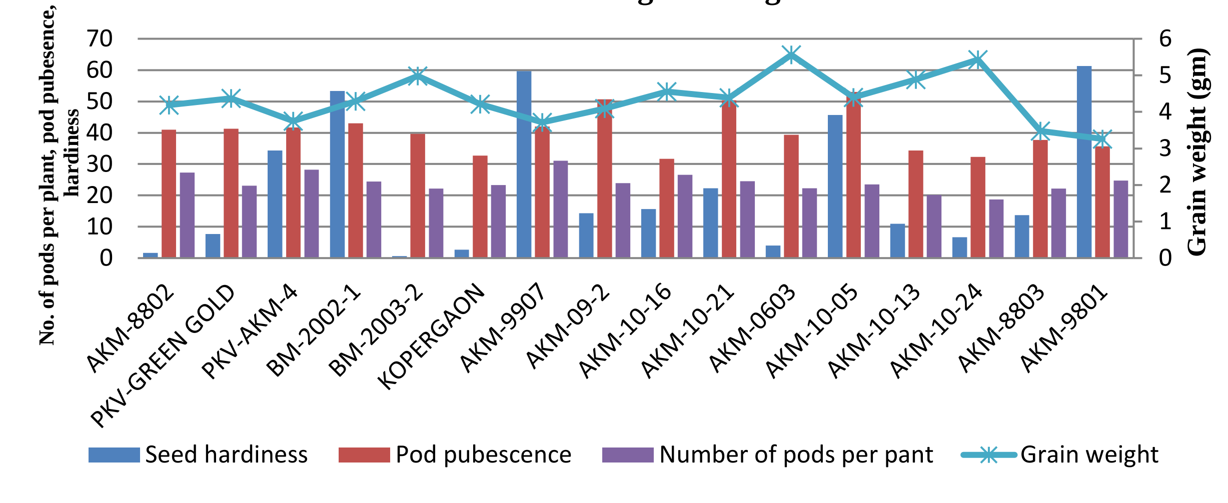
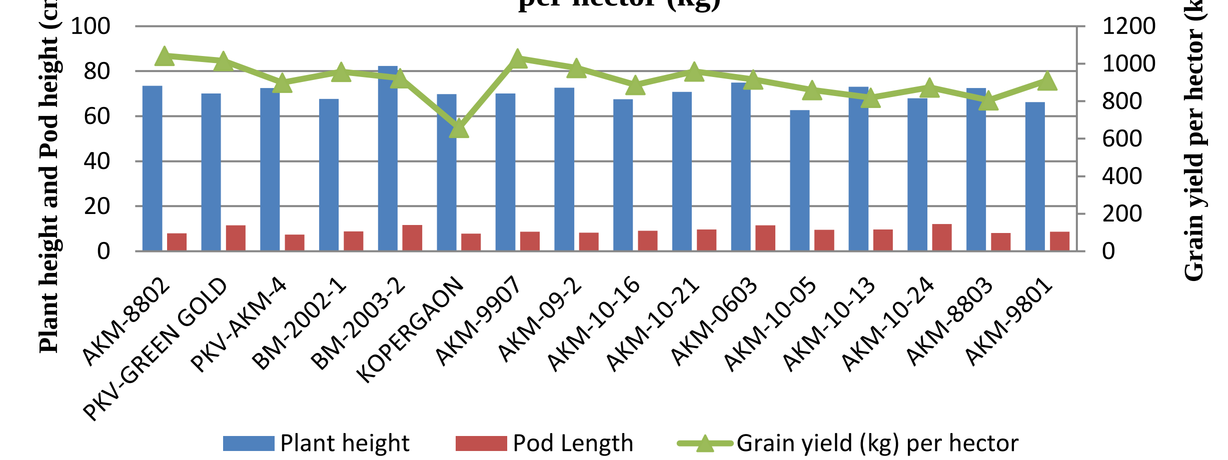


Figure no. 2 data of plant height (cm), pod height (cm) and grain yield per hector (kg)



Seed coat Luster

Among 16 genotypes of Mungbean the genotype PKV-AKM-4 and AKM-09-2 were observed dull apperance of seed coat luster and the other 14 genotypes were show bright seed coat luster. During the maturity period, dew, high humidity, and rainfall increase atmospheric moisture, this is absorbed by dry pods and seeds, increasing the rate of seed respiration and causing testa to expand. When seeds are dried out in between rainy seasons, the testa contract and go back to their physiologically dormant stages. This causes the testa to discolor and crack, which lowers the seed quality and increases the risk of fungal infection.

Pod orientation

The data 15 mungbean genotypes were shown down pod orientation, while the genotype AKM-0603 shown erect pod orientation.

Pod wall thickness

The thin Pod wall was found in genotype PKV-Green Gold, AKM-09-2 and AKM-10-21. Rest of the genotypes of mungbean show thick Pod Wall. The pod wall functions as a barrier, reducing the amount of moisture available, which is essential for the start of germination. Mungbean pod wall thickness is associated with preharvest sprouting tolerance due to water imbibition hindrance. Similar results were found by Tekrony (1980) [14] in soyabean, satyanarayana *et al.* (1987) [13] in mungbean, Anupama *et al*. (2012) [2] in mungbean. However, Cheralu *et al.* (1999) [3] on soyabean, regarding Post harvest sprouting, there was a noteworthy inverse relationship between the thickness of the pod wall and its ability to absorb water. Because a thicker wall can hold and absorb more moisture a condition that is ideal for seed germination there is a higher chance that a seed will sprout inside the pod when the wall is thicker.

Pod Beak

The data pertaining to Pod Beak the genotype AKM-9907 and AKM-0603 were shown curve pod beak and other genotypes of shown straight pod beak.

Pod length (cm)

The Pod length was differed significant in all genotypes. The genotypes AKM-10-24 (12.07 cm) recorded highest pod length followed by BM-2003-2 (11.60 cm) and AKM-0603 (11.60 cm). Significantly lowest pod length were found in to the genotype PKV-AKM-4 (7.36 cm).
The all mungbean genotypes shown significant difference in pod length. Similar results were found by Zaid *et al.* (2012) [16].

Pod pubescence

The genotype AKM-10-05 (53) were recorded highest pod pubescence followed by AKM-10-21 (50.67), AKM-09-2 (50.67). Significantly lowest pod pubescence found in genotype AKM-10-24 (32.33).
The Mungbean Genotype AKM-10-05 (53) recorded highest Pod pubescence which were associated with less pre-harvest sprouting. Similar result found by Dougherty and Boerma (1984) [6] in Soyabean.

Yield and yield attributes

Number of pods per plant: The genotype AKM-9907 (31.11) recorded no. of pods per plant significantly higher than the general mean (24.15). More no. of pods/plant in AKM-9907 resulted into more grain yield in this genotype (1028.35kg/ha).
Grain Weight: The genotype AKM-0603 (5.56 g) recorded significantly higher grain weight than general mean (4.35 g).
Grain Yield (kg) per hectare

The grain yield per hectare was differed significantly in all genotypes. The genotype AKM-8802 (1042.63 kg) recorded highest grain yield (kg) per hectare followed by AKM-9907 (1028.35 kg) and PKV-Green gold (1015.77) and lowest grain yield was found in AKM-8803.

Table no.1(a). Morpho-physiological, yield and yield attributes traits of mungbean genotypes. (b). Morpho-physiological traits of mungbean genotypes

Genotypes	Plant height	Seed hardiness	Pod pubescence	Pod length	Number of pods per pant	Grain weight	Grain yield (kg) per hector
AKM-8802	73.51	1.67	41.00	8.02	27.33	4.19	1042.63
PKV-GREEN GOLD	70.09	7.67	41.33	11.56	23.11	4.37	1015.77
PKV-AKM-4	72.60	34.33	41.67	7.36	28.22	3.75	899.04
BM-2002-1	67.64	53.33	43.00	8.82	24.44	4.29	956.57
BM-2003-2	82.37	0.67	39.67	11.60	22.22	4.98	923.35
KOPERGAON	69.82	2.67	32.67	7.80	23.33	4.21	658.72
AKM-9907	70.10	59.67	42.00	8.62	31.11	3.71	1028.35
AKM-09-2	72.69	14.33	50.67	8.30	23.89	4.09	977.31
AKM-10-16	67.60	15.67	31.67	9.13	26.56	4.55	887.70
AKM-10-21	70.79	22.33	50.33	9.71	24.56	4.39	959.35
AKM-0603	75.00	4.00	39.33	11.58	22.33	5.56	916.06
AKM-10-05	62.77	45.67	53.00	9.60	23.56	4.40	860.86
AKM-10-13	73.06	11.00	34.33	9.70	20.11	4.89	818.66
AKM-10-24	67.99	6.67	32.33	12.07	18.67	5.43	873.70
AKM-8803	72.50	13.67	37.67	8.17	22.22	3.48	806.33
AKM-9801	66.30	61.33	35.67	8.71	24.78	3.26	910.73
Mean	70.93	22.17	40.40	9.42	24.15	4.35	908.45
SE(m)±	0.29	1.77	1.23	0.38	1.10	0.17	27.14
CD at 5%	0.83	5.11	3.54	1.11	3.17	0.50	78.40

Genotypes	Seed Coat Luster	Pod Orientation	Pod Wall thickness	Pod Beak
AKM-8802	Bright	Down	Thick	Straight
PKV-GREEN GOLD	Bright	Down	Thin	Straight
PKV-AKM-4	Dull	Down	Thick	Straight
BM-2002-1	Bright	Down	Thick	Straight
BM-2003-2	Bright	Down	Thick	Straight
KOPERGAON	Bright	Down	Thick	Straight
AKM-9907	Bright	Down	Thick	Curve

AKM-09-2	Dull	Down	Thin	Straight
AKM-10-16	Bright	Down	Thick	Straight
AKM-10-21	Bright	Down	Thin	Straight
AKM-0603	Bright	Erect	Thick	Curve
AKM-10-05	Bright	Down	Thick	Straight
AKM-10-13	Bright	Down	Thick	Straight
AKM-10-24	Bright	Down	Thick	Straight
AKM-8803	Bright	Down	Thick	Straight
AKM-9801	Bright	Down	Thick	Straight

Summary and conclusion

PHS is an abiotic stress that has been shown to reduce mungbean yield by 60-70%. To reduce the losses due to PHS, the experiment was conducted and it is found that on the basis of morpho-physiological traits viz., high hard seed %, pod pubescence, lower germination in pod and seed, less seed and pod moisture genotype AKM-9801, AKM-9907, BM-2002-1 and AKM-10-05, genotypes were found to be tolerant to preharvest sprouting but seed yield per hector found efficient in AKM-8802 and AKM-9907. So it is concluded the AKM-9801, AKM-9907, BM-2002-1 and AKM-10-05 and AKM-8802 are the best suitable genotype to prevent pre harvest sprouting.

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