



Effect of integrated crop management on seed quality in mungbean (*Vigna radiata*)

JITENDER¹, R C PUNIA², V P S SANGWAN³, SATBIR JAKHAR⁴ and HEMENDER⁵

CCS Haryana Agricultural University, Hisar, Haryana 125 004

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ABSTRACT

The present study was conducted at CCSHAU, Hisar during 2015-16 on mungbean var. MH 421 with sixteen treatment combination to assess the effect of integrated crop management on seed quality. The results revealed that treatment, recommended dose of fertilizer (RDF) + recommended weed management (RWM) + recommended pest management (RPM) showed significantly higher test weight (46.38), (45.52), germination percentage (93.67), (91.00), seedling length (48.33), (46.00), seedling dry weight (26.20, 20.23), vigour index-I (4527, 4186), vigour index-II (2454, 1841), germination after accelerated ageing test (76.00, 71.33), in summer and *kharif* season, respectively, over control.

Key words: Accelerated ageing, Germination, Mungbean, Seasons, Seed quality, Vigour indices

Among the food legumes grown in India, mungbean is an ancient and well known leguminous crop. It is popular because of its nutritional quality and is suitable for multiple cropping systems. Good quality seed is the basis for successful seed production programme which in turn will ensure uniform germination and rapid root and shoot development and thus increase yield per unit area. Increase in use of high quality seed is one of the preventive steps against rising food problem. In fact, there has been inter-dependence on use of quality seed and higher yield. However, realization of higher seed yield should always be accompanied by the production of superior quality seed. The location and season in seed production play great role in determining the seed quality, since seed development and maturity is largely influenced by the prevailing climatic conditions at particular location in a given season. Integrated crop management includes use of conventional as well as non-conventional methods of nutrient, pest and weed management in a manner that the soil health and crop-environment interactions will remain in a sustainable mode. There is no study available in the literature related to the effect of integrated crop management on the seed quality of mungbean. So, the present study was designed to assess the effect of various modes of fertilization, weed management and pest management on mung bean crop in summer and *kharif* seasons.

MATERIALS AND METHODS

The present investigation was conducted at Research Farm of Genetics and Plant Breeding and laboratories of Department of Seed Science and Technology, CCS Haryana Agricultural University. Seeds of Mungbean variety MH 421 were collected from Pulses Section, Department of Genetics and Plant Breeding CCS Haryana Agricultural University, Hisar during summer 2015. Sixteen treatments combinations, viz. T1, RDF (Recommended Dose of Fertilizer); T2, RDF+ Biomix (*Rhizobium* + PSB); T3, RDF + ZnSO₄; T4, 50% RDF + ZnSO₄; T5, Biomix; T6, RWM (Recommended Weed Management); T7, RPM (Recommended Pest Management); T8, RDF+RWM; T9, RDF + RPM; T10, RWM + RPM; T11, RDF + RWM + RPM; T12, FYM; T13, FYM + 50% RDF; T14, Vermicompost; T15, Vermicompost + 50% RDF; T0, Control. The variety MH-421 of mungbean with all treatment combinations was grown in the field with three replications. Recommended cultural practices were followed during the entire crop duration which included FYM @ 15 t/ha, N @ 20 kg/ha, P₂O₅ @ 40 kg/ha and ZnSO₄ @ 25 kg/ha as fertilizers; *Rhizobium* @ 150 ml/ha/15 kg seed and PSB @ 150 ml/ha/15 kg as seed treatment; Pendimethalin @ 4000 gm 25 EC/ha + 1 hoeing at 20-25 days for weed management, Metasystox @ 625 ml 25 EC/ha at 14-21 days as pest management. The sowing was done in summer and *kharif*, 2015. The seed obtained from various treatment combinations were used for assessing the seed quality parameters.

Thousand seeds of each replication in each treatment were counted at random and weighed individually on electronic balance and the mean of these observations was recorded as test weight in grams.

One hundred seeds for each treatment were placed

¹Ph D Scholar (e mail: jeetuhau23@gmail.com), ²Professor and Head (e mail: hod-sst@hau.ernet.in), ³Principal Scientist (e mail: vpsangwan@hau.ernet.in), ⁴Assitant Scientist (e mail: jakhar2023@gmail.com), ⁵Ph D Scholar (e mail: tanwar.ht@gmail.com).

on sufficiently moistened rolled papers (BP) at 25°C with 90-95% relative humidity in the seed germinator in three replications. Final count was recorded on 8th day (ISTA 2004). At the time of final seedling evaluation, seedlings were classified as normal seedling, abnormal seedling, dead and hard seeds were recorded as per cent hard seed. Normal seedlings including hard seeds were expressed as germination percentage.

The 10 seedlings were selected randomly from the normal seedlings of each replication in all treatments at the

Table 1 Effect of integrated crop management on test weight and standard germination in mungbean

Treatment	Test weight (g)		Standard germination (%)	
	Summer	Kharif	Summer	Kharif
RDF	43.20	42.83	90.33 (71.92)	86.67 (68.56)
RDF + Biomix	45.52	44.46	93.00 (74.65)	90.00 (71.55)
RDF + ZNSO ₄	41.92	43.09	90.67 (72.19)	84.67 (66.92)
50% RDF + ZNSO ₄	40.66	42.03	87.33 (69.15)	82.00 (64.88)
Biomix	43.19	41.86	86.33 (68.29)	83.67 (66.14)
RWM	41.30	40.23	86.00 (68.01)	83.00 (65.62)
RPM	40.47	39.99	88.00 (69.72)	87.00 (68.84)
RDF + RWM	44.31	43.02	92.33 (73.90)	89.00 (70.61)
RDF + RPM	42.47	41.68	91.67 (73.20)	87.33 (69.13)
RWM + RPM	43.62	40.34	88.33 (70.00)	85.33 (67.46)
RDF + RWM + RPM	46.38	45.52	93.67 (75.40)	91.00 (72.53)
FYM	40.08	38.90	86.00 (68.01)	80.67 (63.89)
FYM + 50% RDF	41.06	40.50	86.67 (68.56)	81.00 (64.14)
Vermicompost	40.32	39.56	87.00 (68.84)	81.00 (64.13)
Vermicompost + 50% RDF	41.33	40.73	85.67 (67.73)	81.67 (64.62)
Control	39.89	38.27	85.33 (67.46)	78.00 (62.01)
Mean	42.23	41.44	88.65 (70.44)	84.50 (66.94)
Range	39.89- 46.38	38.27- 45.52	67.46- 75.40	62.01- 72.53
CD (P=5%)	1.03	0.73	1.48	1.03

Values in parentheses are arc sine transformed of the original.

time of final count of standard germination and measured in cm and average seedling length of each treatment was calculated.

Seedling dry weight was assessed after the final count in the standard germination test (8th day). The 10 seedlings from each treatment were used. Seedlings were dried in a hot air oven for 24 hr at 80±1°C. The dried seedlings of each replication were weighed and average seedling dry weight of the treatment was calculated.

From the observations of standard germination test, the seedling vigour indices were calculated according to the method suggested by Baki and Anderson (1973).

Vigour index-I = Standard germination (%) × Average seedling length (cm)

Where, seedling length = Root length + shoot length

Vigour index-II = Standard germination (%) × Average seedling dry weight (mg)

Seedling dry weight = Ten normal seedling taken for measuring the root and shoot length were further kept in hot air oven at 80°C for 24 hr and average dry weight per seedling was recorded in milligrams.

Sufficient number of seeds in a single layer from each treatment was taken on wire mesh tray fitted in plastic boxes having 40 ml of distilled water. The boxes were placed in

Table 2 Effect of integrated crop management on seedling length and seedling dry weight in mungbean

Treatment	Seedling length (cm)		Seedling dry weight (mg)	
	Summer	Kharif	Summer	Kharif
RDF	43.33	41.00	22.20	15.37
RDF + Biomix	47.67	45.33	24.87	21.57
RDF + ZNSO ₄	43.67	41.67	21.40	18.37
50% RDF + ZNSO ₄	42.67	39.67	22.32	15.73
Biomix	42.33	42.67	18.83	15.57
RWM	42.00	41.67	17.60	16.50
RPM	44.33	39.33	17.93	16.73
RDF + RWM	46.00	43.67	23.83	18.57
RDF + RPM	45.67	43.00	22.37	19.17
RWM + RPM	43.33	39.33	19.26	16.53
RDF + RWM + RPM	48.33	46.00	26.20	20.23
FYM	39.00	37.67	17.54	12.33
FYM + 50%RDF	40.00	40.00	16.51	13.27
Vermicompost	41.33	38.00	16.40	14.86
Vermicompost + 50% RDF	42.00	39.33	17.93	12.50
Control	37.67	36.33	15.57	11.17
Mean	43.08	40.92	20.05	16.15
Range	37.67- 48.33	36.33- 46.00	15.57- 26.20	11.17- 21.57
CD (P=5%)	1.54	0.99	0.33	0.48

Values in parentheses are arc sine transformed of the original.

ageing chamber after closing their lids. The seeds were aged at $40\pm 1^\circ\text{C}$ and about 100% RH for 72 hr and tested for germination in three replications of 100 seeds for each treatment. The number of normal seedlings including hard seeds were counted on 8th day and expressed as per cent germination.

RESULTS AND DISCUSSION

It was evident that there was a significant difference in germination percentage due to different treatments and seasons (Table 1). The 1,000 seed weight was significantly influenced by the integrated crop management and seasons and it ranged from 38.27 to 46.38. Significantly higher (46.38, 45.52) 1,000 seed weight was recorded with the application of RDF + RWM + RPM and it was at par with RDF + Biomix (45.52, 44.46) in both summer and *kharif* seasons. Significantly lower 1,000 seed weight was recorded in control (38.27), (39.89). Among both the seasons, the higher 1,000 seed weight was recorded in summer season (42.33) as compared to *kharif* season (41.44). Significantly higher germination (93.67%, 91.00%) was recorded with the treatment RDF + RWM + RPM and it was at par with RDF + Biomix (93.00%, 90.00%) as compared to control (85.33%, 78.00%) in summer and *kharif* season respectively. Among both the seasons, higher germination was observed in summer season. The range for standard germination was 78.00% to 93.67%.

Seedling length ranged from 36.33 to 48.33 and was

significantly influenced due to different treatment combination as well as seasons (Table 2). Significantly higher seedling length was recorded with RDF + RWM+ RPM (48.33, 46.00) which was at par with RDF + Biomix (47.67, 45.33) in both summer and *kharif* seasons as compared to control (37.67, 36.33). The higher seedling length was observed in summer season crop. Seedling dry weight ranged from 11.17 to 26.20 (Table 2) and it was significantly different for season and all treatment combinations. The maximum seedling dry weight was observed with RDF + RWM + RPM (26.20, 20.23) followed by RDF + Biomix (24.87, 21.57) in summer and *kharif* season respectively. The minimum seedling dry weight was found in control (15.57, 11.17). Among both the seasons, higher seedling dry weight was observed in summer season crop.

The range of vigour index-I as calculated by standard germination (%) multiplied by the seedling length (cm) varied from 2,834 to 4,527 and was significantly influenced by treatments and seasons (Table 3). Among the sixteen treatments, RDF + RWM + RPM (4527, 4186) showed the highest mean value for vigour index-I for both summer and *kharif* seasons and minimum was recorded in control (3,214), (2,834). Seeds obtained from summer season crop recorded higher seed vigour index-I value of 3,826 and was significantly superior to *kharif* season (3,465).

The range of vigour index-II as calculated by standard germination (%) multiplied by the seedling dry weight (mg) varied from 871 to 2,454 (Table 3) and differences in the values due to different treatments as well as seasons were

Table 3 Effect of integrated crop management on vigour indices and accelerated ageing in mungbean

Treatment	Vigour Index-I		Vigour Index-II		Accelerated ageing 72 h (%)	
	Summer	<i>Kharif</i>	Summer	<i>Kharif</i>	Summer	<i>Kharif</i>
RDF	3915	3553	2005	1332	69.00 (56.15)	65.33 (53.91)
RDF + Biomix	4433	4080	2313	1941	74.67 (59.76)	68.33 (55.73)
RDF + ZNSO ₄	3959	3358	1940	1333	69.67 (56.56)	66.33 (54.51)
50% RDF + ZNSO ₄	3726	3417	1949	1506	69.33 (56.35)	63.00 (52.52)
Biomix	3655	3569	1626	1302	70.00 (56.77)	65.67 (54.11)
RWM	3612	3458	1514	1370	68.00 (55.53)	62.33 (52.12)
RPM	3901	3422	1578	1456	68.67 (55.94)	63.33 (52.71)
RDF + RWM	4248	3887	2200	1652	72.67 (58.46)	69.00 (56.14)
RDF + RPM	4187	3755	2051	1674	71.00 (57.40)	70.33 (56.98)
RWM + RPM	3827	3356	1701	1411	70.00 (56.77)	67.67 (55.32)
RDF + RWM + RPM	4527	4186	2454	1841	76.00 (60.65)	71.33 (57.61)
FYM	3354	3039	1509	995	67.00 (54.92)	58.00 (49.58)
FYM + 50%RDF	3466	3240	1431	1074	69.00 (56.15)	61.67 (51.73)
Vermicompost	3596	3078	1427	1203	68.00 (55.53)	58.33 (49.78)
Vermicompost + 50% RDF	3598	3212	1537	1021	68.67 (55.94)	60.00 (50.75)
Control	3214	2834	1329	871	65.67 (54.11)	57.00 (49.01)
Mean	3826	3465	1785	1373	69.83 (56.68)	64.23 (53.28)
Range	3214-4527	2834-4186	1329-2454	871-1941	54.11-60.65	49.01-57.61
CD (P=5%)	155	94	38	43	0.84	0.92

Values in parentheses are arc sine transformed of the original.

significant. It was recorded highest in RDF + RWM + RPM (2,454, 1,841) for summer and *kharif* season respectively and the lowest was found in control (1,329, 871). Seed obtained from the crop raised during summer season showed higher value (1785) compared to *kharif* raised crop (1,373).

After accelerated ageing of 72 hr, the treatment RDF + RWM + RPM (Table 3) showed maximum (76.00%, 71.33%) germination in summer and *kharif* season respectively whereas control showed minimum values (65.67%, 57.00%). On comparing the season, after accelerated ageing 72 hr germination was found significantly higher in the seeds obtained from summer season crop with overall mean (69.83%) as compared to *kharif* season crop (64.23%). This may be due to presence of higher amount of metabolites, i.e. sugars, amino acids, fatty acids etc. which helps in resumption of embryonic growth during germination. In addition to these metabolites, release of certain enzymes, i.e. amylases, proteases, peptidases etc. is responsible for degradation of macromolecules into simpler ones within the seed. This could be due to accumulation of required growing degree days in shorter period of time owing to increased temperature. The improved seed quality may also be due to availability of adequate moisture during vegetative phase and a dry period at crop maturity. Higher nutrition content of mother plant which reflects on seed quality due to accumulation of higher quantity of seed constituents like protein and carbohydrates. Similar results were reported by Channaverswami (2005) in groundnut, Barua and Barua (2000) in mungbean, Uppar and Kumar (2007) in mothbean, Ahamed (1999) in blackgram, Singh *et al.* (2007) in pea and Umesh *et al.* (2007) in sunflower. Among both seasons, the summer season crop showed superiority over *kharif* season for almost all the parameters, which might be due to the fact that crop had to be harvested under high humidity and low temperature. The variation in germination between the seasons could be attributed to the better development of seed during summer season which reflected the higher test weight in summer than *kharif*. Higher seed vigour indices in summer compared to *kharif* may be due to the seeds being better with better food reserves. Similar results were also reported in Pigeonpea (Kalpana and Madhav Rao 1996, Kharb and Dahiya 2000)

and mung bean (Maity *et al.* 2000, Murthy and Sun 2000, Murthy *et al.* 2003).

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