Website : www.asthafoundation.in
Frontiers in Crop Improvement
Vol 12 (1) : 51-55 (January-2024) Print ISSN : 2393-8234 Online ISSN : 2454-6011
Astha Foundation, Meerut (U.P.) India

Seed Dormancy Studies in Mungbean (*Vigna radiata* L. Wilczek)

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Abstract

The present study entitled, "Seed dormancy studies in mungbean (*Vigna radiata* L. Wilczek)" was carried out during kharif 2021-22. The treatments were applied by the foliar application at 50 and 60 days after sowing. Field observations like number of pods per plant, pod length(cm), number of seeds per pod, seed index(g), pod yield per plant(g), pod yield per plot(kg), seed yield per plant (g), seed yield per plot (kg), seed yield (kg/ha) and laboratory observations like germination percentage (%) and rate of germination were recorded. The results exhibited significant differences in yield and yield contributing characters due to foliar spray when compared to the control. Among the treatments, maleic hydrazide 250 ppm gave higher yield and yield contributing characters as compared to other treatments. The plot sprayed with maleic hydrazide 250 ppm recorded significantly higher no. of pods per plant (29.70), pod length (13.6), no. of seeds per pod (13.20), seed index (3.72 g), pod yield per plant (37.18 g), pod yield per plot (1.86 kg), seed yield per plant (29.27 g), seed yield per plot (1.46 kg), seed yield (13.00 kg/ha). It is important to induce dormancy by non-conventional methods i.e., foliar application of maleic hydrazide and paclobutrazol at flowering and pod initiation stages to save the produce and retain seed quality against field sprouting.The findings of the present study concluded that among all the treatments, foliar spray of maleic hydrazide 250 ppm at flowering and pod initiation stages recorded the highest seed yield as well as high no. of pods per plant, no. of seeds per pod, seed index and was also superior for inducing seed dormancy up to 35 days after storage without affecting the yield.

Keywords : *Seed dromancy, growth, parameters, mungbean.*

Introduction

Mungbean (*Vigna radiata* L. Wilczek) is one of the most ancient and extensively grown leguminous crops of India.. It is a short duration crop, rich in protein and vitamin B. In India, mungbean is widely cultivated throughout India.

Mungbean is also called as greengram (Chromosome No. 2n=22). Mungbean is an excellent source of protein (25%) which is 2-2.5 time more than cereals. Dal or sprouted seeds are easily digestible and hence prefer to medical patients. It is also a good source of Calcium 124 mg/100 g, Fat 1.3%, Phosphorus 326 mg/100 g, Minerals 3.5%, Iron 7.3 mg/100 g, Fiber 4.1% Calorific value 334 Kcal/100 g, Carbohydrate 56%. (1). It is a leguminous crop which fix the atmospheric nitrogen by symbiotic association through rhizobium (30-40 kg N/ha). Vivipary, also refers to *in situ* germination of seeds while still developing on the mother plant. It manifests an uninterrupted progression of development from embryogenesis to germination without an intervening period of maturation marked by events like desiccation, storage of reserves, quiescence and dormancy. The pre-harvest sprouting of the seeds of pods of mungbean causes considerable yield loss due to sprouting of seeds in pods in the fields. Pre-harvest sprouting would imply germination of well-developed physiologically mature seeds prior to their harvest. This situation occurs under excess moisture conditions caused by extended and frequent rains, heavy dew, high humidity and even low temperature. The pre-harvest sprouting is sometimes referred to as weather damage. Weather damage is a general term used to describe a range of adverse physical and chemical changes that occur in seed following its exposure to rainfall and humidity. In view of the substantial losses caused by pre-harvest sprouting, it is imperative to develop pre-harvest sprouting tolerant varieties or a need to identify sources of short duration with certain period of dormancy to minimize yield losses due to *in situ* germination.

However, the information on pre-harvest sprouting is lacking because little work has been done on this aspect of the crop. Dormancy is an important factor in commercial mungbean production. It can be beneficial when dormancy prevents mature seeds from sprouting before harvest. It can be detrimental when dormancy reduces stand or hampers taking a second crop immediately after harvest. Lack of dormancy in mungbean has been described as an inherent property of seed and does not primarily depend on soil conditions.

The search for investigation of non-conventional methods of inducing dormancy in mungbean to save the produce and to retain the seed quality against the field sprouting are of greater importance. For inducing seed dormancy in mungbean number of methods have been developed. Foliar application of maleic hydrazide at

Received : October-2023; Revised : October-2023; Accepted : November-2023

different stages of crop growth has been successfully used to control sprouting. The key idea in the use of growth regulators is to control some aspects of growth, regulate the balance between source and sink, which is the final analysis results in the higher yield of desired product.

Materials and Methods

The present study entitled "Seed dormancy studies in mungbean (*Vigna radiata* L. Wilczek)" was conducted during *kharif* 2021 at the field of "Seed Technology Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The field experiment comprised of Mungbean genotype PKV-Green Gold and nine sprays inclusive of the control treatment. Total treatment combinations were 27 with three replications. The laboratory test was conducted at Seed Technology Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola. The laboratory tests were conducted at Seed Technology Research Unit, Dr. PDKV Akola during 2021-2022. The mungbean genotype was grown in completely randomized design with three replications and nine treatments. The field experiment was conducted at the field of Seed Technology Research Unit, Dr. PDKV Akola. The experimental design used was randomized block design with three replications and nine treatments. Five normal and healthy plants were selected randomly from net plot area of each experimental plot and were tagged with a wax coated label for recording observations of various growth parameter, seed yield and yield component and seed quality parameters of the present study. All mean values and data were computed and analyzed with statistical procedures as suggested by (2).

Results and Discussion

Dormancy is the major problem in mungbean. Therefore, it is important to induce the dormancy by non-conventional methods to save the produce and retain seed quality against field sprouting.

The period of prolonged rainfall after the seed has ripened to harvest may contribute to pre harvest losses. Now a days preharvest sprouting due to heavy rainfall is a serious problem in mungbean which causes severe damage and alter seed quality. The dormancy and germination are two important characters which determine the quality of seed and are controlled by the combination of morphology, physiology and physical structures (3). Dormancy will be beneficial when it prevents mature seeds from sprouting before harvest. The search for non-conventional methods of inducing dormancy in mungbean to save the seed produce and to retain the seed quality against the field sprouting are of greater importance and this can be achieved by using various concentrations of maleic hydrazide and paclobutrazol in present study.

In situ germination of the seeds manifests an uninterrupted progression of development from embryogenesis to germination without an intervening period of maturation marked by events like desiccation, storage of reserves, quiescence and dormancy. The pre-harvest sprouting of the seeds of pods of mungbean causes considerable yield loss due to sprouting of seeds in pods in the fields. Pre-harvest sprouting would imply germination of well-developed physiologically mature seeds prior to their harvest. This situation occurs under excess moisture conditions caused by extended and frequent rains, heavy dew, high humidity and even low temperature. Nearly 60-70% of yield losses have been reported in green gram and black gram due to pre-harvest sprouting. The pre-harvest sprouting is sometimes referred to as weather damage. Considering the problem of pre harvest sprouting, the present investigation was undertaken to control some aspects of growth, regulate the balance between source and sink, which is the final analysis results in the higher yield of desired product.

The Field and lab experiment was conducted to study the induction of dormancy in mungbean variety (PKV Green Gold) by different chemicals like maleic hydrazide with 250 ppm, 500 ppm, 750 ppm and 1000 ppm and paclobutrazol 200 ppm, 400 ppm, 600 ppm and 800 ppm sprayed at flowering and pod initiation stage i.e., 50 and 60 days after sowing along with control. The present study was discussed with following sub heads:

Growth Parameters : In Mungbean basically, the plant height is a genetically controlled character, but several studies have indicated that the plant height can be increased or decreased by the study of dormancy inducing chemicals like Maleic hydrazide and Paclobutrazol.

In the present study the plant height at 60 days after sowing and 75 days after sowing differ significantly. The data was ranged from 48.2 cm to 54.2 cm for 60 days after sowing and 50.9 cm to 56.00 cm for 75 days after sowing. The mean of plant height at 60 and 75 days after sowing for all the treatments are 50.8 cm and 53.4 cm respectively. The treatment maleic hydrazide 1000 ppm and paclobutrazol 800 ppm shows lowest height 48.2 cm and treatment paclobutrazol 200 ppm shows highest height 54.2 cm for 60 days after sowing. The treatment paclobutrazol 800 ppm shows lowest height 50.9 cm and treatment paclobutrazol 200 ppm shows highest height 56 cm for 75 days after sowing. Similar results were reported by (4), reported that among maleic hydrazide and paclobutrazol foliar application of maleic hydrazide recorded lesser plant height as compared to paclobutrazol. And among the treatments spraying the

Table-1 : Effect of Maleic Hydrazide and Paclobutrazol on Yield and Yield contributing characters in Mungbean.

Treatments	No. of pods per plant	Pod length (cm)	No. of Seeds per pod	Seed Index(g)	Pod Yield per Plant (g)	Pod Yield per plot (kg)	Seed Yield per plant (g)	Seed Yield per plot (kg)	Seed Yield (kg/ha)
T1 Control	24.87	11.02	10.30	3.36	28.70	1.40	19.20	0.96	850
T2 Maleic Hydrazide 250 PPM	29.70	13.61	13.40	3.72	37.18	1.86	29.27	1.46	1300
T3 Maleic Hydrazide 500 PPM	26.73	12.62	11.19	3.66	35.93	1.80	28.40	1.42	1260
T4 Maleic Hydrazide 750 PPM	26.10	12.33	10.90	3.46	34.95	1.75	26.66	1.33	1187
T5 Maleic Hydrazide 1000 PPM	25.30	11.14	10.63	3.39	34.52	1.69	25.00	1.25	1110
T6 Paclobutrazol 200 PPM	25.47	10.35	11.10	3.40	33.73	1.69	26.03	1.30	1157
T7 Paclobutrazol 400 PPM	26.23	11.47	11.40	3.47	35.20	1.76	27.78	1.39	1230
T8 Paclobutrazol 600 PPM	28.47	12.06	12.50	3.53	36.40	1.81	28.67	1.43	1277
T9 Paclobutrazol 800 PPM	29.40	12.92	13.20	3.64	36.83	1.84	29.03	1.45	1290
SE (M)	1.58	0.59	0.67	0.13	1.51	0.08	1.64	0.08	0.70
CD (5%)	4.74	1.76	1.99	0.38	4.51	0.25	4.91	0.24	2.10

Table-2 : Effect of Maleic Hydrazide and Paclobutrazol on germination percentage in mungbean.

Treatments	0 DAS*	10 DAS*	20 DAS*	30 DAS*	40 DAS*
T1 Control	85.0	83.0	81.0	81.0	79.0
	(67.21)	(65.65)	(64.15)	(64.15)	(62.72)
T2 Maleic Hydrazide 250 PPM	44.0	56.0	67.0	77.0	74.0
	(41.55)	(48.45)	(54.94)	(61.34)	(59.32)
T3 Maleic Hydrazide 500 PPM	41.0	52.0	65.0	75.0	71.0
	(39.82)	(45.15)	(53.73)	(60.02)	(57.42)
T4 Maleic Hydrazide 750 PPM	40.0	51.0	63.0	74.0	70.0
	(39.23)	(45.57)	(52.53)	(59.34)	(56.78)
T5 Maleic Hydrazide 1000 PPM	38.0	49.0	61.0	72.0	69.0
	(38.06)	(44.43)	(51.35)	(58.05)	(56.17)
T6 Paclobutrazol 200 PPM	42.5	52.0	65.0	73.0	70.0
	(40.69)	(46.15)	(53.73)	(58.68)	(56.75)
T7 Paclobutrazol 400 PPM	40.6	49.0	63.0	71.0	69.0
	(39.58)	(44.43)	(52.53)	(57.42)	(56.17)
T8 Paclobutrazol 600 PPM	39.0	45.0	60.0	69.0	67.0
	(38.65)	(42.13)	(50.77)	(56.17)	(54.94)
T9 Paclobutrazol 800 PPM	37.0	42.0	58.0	65.0	63.0
	(37.47)	(40.40)	(49.60)	(53.73)	(52.53)
SE(M)	1.61	2.177	2.713	2.748	2.641
CD (5%)	4.833	6.519	8.122	8.230	7.908

Figures in parenthesis are arcsin transformed value (*indicates days after storage, MH- Maleic hydrazide, PB- Paclobutrazol)

crop with maleic hydrazide 1000 ppm recorded significantly less plant height at 60 days after sowing and at harvest stage. The inhibitory effect on plant height by maleic hydrazide might be due to the inhibition of cell division and reduction in cell growth and expansion.

In the present study the number of branches at 60 days after sowing and 75 days after sowing differ significantly. The data ranged from 4.3 to 5.4 for 60 days after sowing and 5.2 to 5.8 for 75 days after sowing. The treatment paclobutrazol 800 ppm shows lowest branches i.e., 4.3 and treatment maleic hydrazide 250 ppm and maleic hydrazide 500 ppm shows highest branches 5.4 for 60 days after sowing. The treatment control and paclobutrazol 800 ppm shows lowest branches i.e., 5.2 and treatment paclobutrazol 600 ppm shows highest branches i.e., 5.8 for 75 days after sowing. Similar results were found by Menedel S. M. (2015).The inhibition of apical growth may have been due to the effect of maleic hydrazide on cell division and plant polar auxin transport.

Yield and Yield Contributing Characters : In the present study the significant differences were noticed in the yield parameters with the foliar spray of maleic hydrazide and paclobutrazol when compared to control. Among the treatments maleic hydrazide 250 ppm gave higher yield and yield parameters like number of pods per plant, pod length, number of seeds per pod, seed index, pod yield per plant, seed yield per plant, seed yield per plot, seed yield per hectare as compared to other treatments.

The experimental plot sprayed with maleic hydrazide 250 ppm recorded significantly higher number of pods per plant (29.70),pod length (13.61 cm), number of seeds per pod (13.40), seed index (3.72 g), pod yield per plant (37.1

Table-3 : Effect of Maleic Hydrazide and Paclobutrazol on rate of germination in mungbean.

Treatments	0 DAS*	10 DAS*	20 DAS*	30 DAS*	40 DAS*
T1 Control	35.07	34.42	33.38	32.77	30.68
T2 Maleic Hydrazide 250 PPM	11.87	14.92	17.57	20.40	21.90
T3 Maleic Hydrazide 500 PPM	12.97	16.25	21.73	25.40	29.65
T4 Maleic Hydrazide 750 PPM	14.72	17.25	21.90	26.90	31.57
T5 Maleic Hydrazide 1000 PPM	16.68	18.72	25.32	27.62	32.57
T6 Paclobutrazol 200 PPM	16.91	18.85	25.87	27.94	32.68
T7 Paclobutrazol 400 PPM	17.16	19.21	26.31	28.34	33.14
T8 Paclobutrazol 600 PPM	17.68	19.94	26.76	28.94	33.67
T9 Paclobutrazol 800 PPM	18.34	20.31	27.23	29.01	34.24
SE (M)	0.138	0.14	0.072	0.177	0.085
CD (5%)	0.413	0.421	0.214	0.53	0.255

(* indicates days after storage, MH- Maleic hydrazide, PB- Paclobutrazol)

g), pod yield per plot (1.86 kg), seed yield per plant (29.27 g), seed yield per plot (1.46 kg) and seed yield per hectare (1300 kg) followed by paclobutrazol 800 ppm pods per plant (29.40),pod length (12.92 cm), number of seeds per pod (13.20), seed index (3.64 g), pod yield per plant (36.83 g), pod yield per plot (1.84 kg), seed yield per plant (29.03 g), seed yield per plot (1.45 kg) and seed yield per hectare (1290 kg) respectively.

The pod and seed yield and its contributing traits such number of pods per plant, pod length, number of seeds per pod, seed index were influenced by the application of lower concentrations of maleic hydrazide.

These results are in confirmation for maximum yield with application of maleic hydrazide 250 ppm compared to other treatments (Anonymous, 2014-15). The study also confirms with the (4).

Seed Quality Parameters : In present study after harvest of mungbean, the resultant seeds were analyzed for various seed quality parameters. All the treatments differed significantly on all seed quality parameters. The seeds were tested for quality parameters in the lab as per the ISTA Rules (2011) until the dormancy get broken. The study was carried from zero days after storage to 40 days after storage.

Among the foliar applications of maleic hydrazide and paclobutrazol at different concentrations, reduced the germination of seeds in view of induction of dormancy as compared to control sample. The genotype (PKV Green Gold) had non dormant nature it could be seen from the control sample which recorded the highest per cent of germination (85.00, 83.00, 81.00, 81.00, 79.00) the decreasing trend of germination per cent was due to the seed deterioration effect. The other concentrations of the chemicals failed to induce dormancy as much as of maleic hydrazide 1000 ppm, as the other dose concentration might have limited penetration and translocation of the chemical to the growing meristem. The dormancy may block the sequential process involved in the germination.

Similar results were confirmed for maximum dormant seeds with application of maleic hydrazide 1000 ppm compared to other treatments (5). Also confirms with the (4), and also with the results reported by (6).

The rate of germination increases from zero days after storage to 40 days after storage in almost all treatments except control. In control treatment, the rate of germination decreases from zero days after storage (35.07) to 40 days after storage (30.65).

The given data for seedling length, vigour index, rate of germination and dry weight were supported by the findings of (4), the results show that with the advancement of storage period, seedling length and dry weight was increased drastically irrespective of the treatments combination except with control treatment.

The foliar application of maleic hydrazide 1000 ppm at flowering and pod initiation stages, lower the germination percentage of seed. Similar treatment also exhibited increase in rate of germination from zero to 40 days after storage.

It was concluded that among all the treatments, the foliar spray of maleic hydrazide 250 ppm was found significantly superior in seed yield 1300 kg per hectare area and also superior for inducing dormancy upto 35 days in mungbean.

Conclusions

The present study entitled "Seed dormancy studies in mungbean (*Vigna radiata* L.Wilczek)" was conducted during *kharif* 2021 at the field of Seed Technology Research Unit, Dr. PDKV, Akola. The important findings of the present studies are depicted in this chapter.

Pre harvest spray of different dormancy inducing chemicals at flowering and pod initiation stages of crop growth showed significant differences for seed yield and seed quality attributes in mungbean.

In the present study, the significant differences were noticed in the yield parameters with the foliar spray of maleic hydrazide and paclobutrazol when compared to control. Among the treatments maleic hydrazide 250 ppm gave higher seed yield and yield contributing characters like number of pods per plant, pod length, number of seeds per pod, seed index, pod yield per plant, seed yield per plant, seed yield per plot, seed yield kg per hectare as compared to other treatments.

Seed quality parameters like highest germination per cent and rate of germination were found significantly higher in control followed by maleic hydrazide 250 ppm and paclobutrazol 200 ppm. This might be due to lethal inhibitory effect of maleic hydrazide.

From the present study it is concluded that the foliar spray of maleic hydrazide 250 ppm at flowering and pod initiation stages induced seed dormancy without affecting seed yield and seed quality parameters in mungbean.

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