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Impact of sowing periods on incidence of pod borers in summer mungbean

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Abstract
Study the impact of sowing dates on incidence of pod borers revealed significant lowest population and percent pod damage by *Maruca vitrata* Fabricius and *Helicoverpa armigera* Hubner recorded on crop sown during 4th week of February (late sown) and it was remained at par with 3rd week of February (mid late sown). Moreover, genotype NKM 15-12 was recorded less percent pod damage by *M. vitrata* and *H. armigera*, respectively. The interaction effect of sowing dates and varieties had no significant influence on *M. vitrata* and *H. armigera* infestation. The mungbean crop sown on 3rd week of February (mid late) recorded significant highest grain yield (703 kg/ha). Thus, results of above findings is indicated that the mid late and late sowing *i.e.* 3rd and 4th week of February is the best sowing time for all the three mungbean varieties/genotype as it has less pest infestation and higher grain yield. The genotype NKM 15-12 and NKM 15-08 have significant least infestation of borers and gave higher yield.

Keywords: Mungbean, pod borers, sowing date and yield

Introduction
Pulses, the food legumes, have been constitute an excellent supplement of protein in the vegetarian diet of human beings and play a significant role in balanced food to the people of India Nene, 2006 and many other countries in the world. There are various constraints for low production in mungbean. Though having high production potential than productivity in general low as they are cultivated on poor lands with little inputs and susceptible at several biotic and abiotic stresses, out of these insect pests on green gram play a major role in low production. The most serious insect pest attacking on mungbean includes the whitefly (*Bemisia tabaci* Gennadius), bean thrips (*Megalurothrips distalis* Karny), gram pod borer (*Helicoverpa armigera* Hubner) and legume pod borer (*Maruca vitrata* Geyer) Kooner *et al.*, 2006 [4]. Spotted pod borer and gram pod borer are major constraints in production of mungbean. Pest appearance, population fluctuation infestation rate and crop yield are very much dependent on sowing time. Most of the farmers usually, sown mungbean just after harvesting the *rabi* crops without considering optimum sowing dates. As a result crop growth affected by unfavourable prevailing climatic condition and also crop received higher pest infestation and accordingly yield becomes reduced. Therefore, the present study was undertaken.

Materials and Methods
To study the impact of sowing date on incidence of pod bores the mungbean varieties/genotypes (Meha, NKM-15-08 and NKM-15-12) were sown in a plot size 2.7 m x 4.0 m with a spacing 45 cm × 10 cm in different sowing periods *i.e.* 1st week of February, 2nd week of February, 3rd Week of February and 4th week of February during *Summer* 2017 at College farm, N.A.U, Navsari. The experiment was laid out in a Factorial Randomized Block Design (FRBD) with three replications. All the recommended agronomical practices were followed to raising the crop. Experimental area was kept free from insecticidal spray throughout the season. For observation on spotted pod borer, *M. vitrata* and gram pod borer, *H. armigera* numbers of larvae were counted by visual search method (on whole plant bases) on five plants form each net plot per replication at weekly interval. Mean population of *M. vitrata* and *H. armigera* per plant was worked. Three hundred pods were randomly collected from the net plot (not more than 50 pods/plant) and examine for damage due to *M. vitrata* and *H. armigera*. Percent pod damage by *M. vitrata* and *H. armigera* was work out. The data statistically analysis after proper transformation. With a view to evaluate the effect of different period of sowing on the yield, the plants of net plot area were harvested treatment wise.

The yield thus obtained was converted into hectare basis for each treatment.

Results and Discussion

Spotted pod borer, *Maruca vitrata Geyer*

The data (Table 1) on impact of sowing period on infestation of *M. vitrata* was found significant indicating that the incidence of pest had a direct relation on the different date of sowing. The highest number of *M. vitrata* (0.27 larvae per plant) was found in crop sown on 1st week of February (early sown) while, lower number of *M. vitrata* (0.15 larvae per plant) recorded on crop sown on 4th week of February (late sowing), which was significantly similar with 3rd week of February sown crop (0.18 larvae per plant). These results are in contradiction with those of Prodhan *et al.,* (2008) [6] they observed the maximum pod borer infestation in late sowing. The variation might due to difference in prevailing abiotic factors *viz*., temperature, humidity, at different location. *M. vitrata* incidence significantly varied in different mungbean cultivars. Among the three cultivars, the lowest number of *M. vitrata* larvae (0.16 larvae per plant) was recorded in genotype NKM 15-12. While, significantly highest number of larvae observed in variety Meha (0.26 larvae per plant). The result could not compare with other due to lack of exact reference.

Gram pod borer, *Helicoverpa armigera* Hubner

Number of larval population of *H. armigera* per plant significantly varied under different sowing dates (Table 1). The highest number of *H. armigera* (0.18 larvae per plant) was found in crop sown on 1st week of February (early sowing) while, lower number of *H. armigera* (0.05 larvae per plant) recorded on crop sown on 4th week of February (late sowing), which was significantly at par with 3rd week of February sown crop (0.10 larvae per plant). Similar observation was reported by Jamor and jamir (2015) [3] they found that minimum population of *H. armigera* found in late sown crop of pea. Similar to sowing dates, varieties also had significant effect on *H. armigera* infestation on mungbean crop. The variety Meha show the highest number of *H. armigera* (0.16 larvae per plant) while, lower number of *H. armigera* were observed in NKM 15-12 (0.07 larvae per plant). The difference of larval population of *H. armigera* in different varieties might be due to difference in morphological and biochemical character.

The interaction of sowing dates and varieties had no significant influence on the *M. vitrata* and *H. armigera* population (Table 2). Considering all sowing dates and varieties, genotype NKM 15-12 and NKM 15-08 sown on 4th week of February (late sowing) had less number of *M. vitrata* and *H. armigera* population and while, variety Meha sown on 1st week of February (early sowing) showed highest number of *M. vitrata* and *H. armigera*.

Effect of sowing date and variety on the percent pod damage by *M. vitrata* and *H. armigera*

The damage potential of lepidopteran pod borer, *M. vitrata* in various sowing dates and varieties were assessed through percent pod damage (Table 1). Sowing dates showed significant influence in pod damage. It is evident from the results that the late sowing in 4th week of February had the significant lowest percent pod damage (5.48%) by *M. vitrata*. While, the highest percent pod damage was recorded in early sown crop during 1st week of February (6.89%). The present studied were differing from earlier study of Prodhan *et al*., 2008 [6] according to him earlier planting of blackgram gave lower pod borer infestation than late planting. Variation in present finding might be due to difference in crop and climatic condition. Similar to sowing dates, varieties also had significant effect on percent pod damage by *M. vitrata* in mungbean. The variety NKM 15-12 showed (Table 1) the lower pod damage (5.72%) and remained at par with variety NKM 15-08 (6.03%).

Sowing dates showed (Table 1) significant influence in pod damage by *H. armigera*. It is evident from the results that the late sowing in 4th week of February had the significant lowest percent pod damage (2.67%) by *H. armigera* while, the significant highest percent pod damage was recorded in early sown crop during 1st week of February (3.56%). The present studies differ from earlier studies of Akhter *et al*., (2014) [1] they found that the early sowing of chickpea resulted in lower pod damage percent by *H. armigera.* The variation in present finding might be due to physiological and morphological character of varieties.

Varieties had non-significant effect on percent pod damage by pod borer in mungbean. The variety NKM 15-12 showed (Table 2) the lower pod damage (2.83%) and remained followed with variety NKM 15-08 (3.06%). The interaction effect of sowing dates and variety with the incidence of pod damage by *M. vitrata* and *H. armigera* were found non-significant (Table 2).

Effect of sowing dates and varieties on the grain yield of mungbean

Grain yield of mungbean significantly varied to the different sowing dates and insect pest infection (Table 1). The data indicated that 3rd week February (mid late sown) sown crop recorded significantly higher grain yield (703 kg per ha) as compared to subsequent sowing, while, the lowest yield was noticed in early sowing *i.e.* 1st week February sowing (623 kg per ha). The present study are in accordance with those of Hossian *et al*., (2009) [2] they found that early and late sown mungbean crop received higher infestation of insect pest and less grain yield. Similar to sowing dates, varieties also had significant effect on grain yield. The variety NKM 15-12 showed the significant highest grain yield (692 kg per ha), while variety Meha showed lowest grain yield (625 kg per ha). The interaction effect of sowing dates and variety on grain yield was found non-significant (Table 2).

Table 1: Effect of sowing dates and varieties on incidence of pod borers

Factor	Treatments	Larval population per plant *		Percent pod damage #		Grain yield (Kg/ha)
		M. vitrata	*H. armigera*	*M. vitrata*	*H. armigera*	
1. Sowing Date (D)	D1- 1st week February	0.87 (0.27)	0.83 (0.18)	15.18 (6.89)	10.84 (3.56)	623
	D2- 2nd week February	0.86 (0.25)	0.78 (0.10)	14.89 (6.63)	10.47 (3.33)	643
	D3- 3rd week February	0.82 (0.18)	0.77 (0.10)	13.99 (5.89)	9.59 (2.81)	703
	D4- 4th week February	0.81 (0.15)	0.74 (0.05)	13.48 (5.48)	9.35 (2.67)	664
	S.Em ±	0.018	0.018	0.40	0.36	16.18
	C.D. at 5%	0.051	0.053	1.17	1.05	47.32
2. Varieties (V)	V1- Meha	0.87 (0.26)	0.81 (0.16)	15.22 (6.92)	10.53 (3.39)	625
	V2- NKM-15-08	0.85 (0.23)	0.77 (0.09)	14.16 (6.03)	10.03 (3.06)	658
	V3- NKM-15-12	0.81 (0.16)	0.70 (0.07)	13.78 (5.72)	9.63 (2.83)	692
	S.Em ±	0.015	0.015	0.34	0.31	14.04
	C.D. at 5%	0.045	0.045	1.01	NS	40.98

Figure in parentheses are original value whereas, those outside are √x + 0.5 *and arcsine# transformed values

Table 2: Interaction effect of sowing dates and varieties on incidence of pod borers

Date of sowing	Variety	Larval population per plant*		Percent pod damage#		Grain yield (Kg/ha)
		M. vitrata	*H. armigera*	*M. vitrata*	*H. armigera*	
D1	Meha	0.90 (0.31)	0.85 (0.22)	16.05 (7.67)	11.53 (4.00)	590
	NKM 15-08	0.89 (0.30)	0.82 (0.18)	14.41 (6.22)	10.51 (3.33)	625
	NKM 15-12	0.85 (0.22)	0.80 (0.15)	15.08 (6.78)	10.49 (3.33)	655
D2	Meha	0.90 (0.32)	0.81 (0.16)	15.57 (7.22)	10.84 (3.56)	621
	NKM 15-08	0.87 (0.26)	0.77 (0.09)	14.82 (6.56)	10.45 (3.33)	649
	NKM 15-12	0.82 (0.17)	0.75 (0.06)	14.28 (6.11)	10.12 (3.11)	657
D3	Meha	0.85 (0.23)	0.83 (0.19)	14.96 (6.67)	10.04 (3.11)	672
	NKM 15-08	0.83 (0.19)	0.75 (0.06)	14.13 (6.00)	9.76 (2.89)	699
	NKM 15-12	0.80 (0.13)	0.74 (0.05)	12.89 (5.00)	8.98 (2.44)	736
D4	Meha	0.83 (0.19)	0.76 (0.08)	14.30 (6.11)	9.71 (2.89)	616
	NKM 15-08	0.82 (0.17)	0.74 (0.04)	13.28 (5.33)	9.39 (2.68)	657
	NKM 15-12	0.79 (0.12)	0.73 (0.04)	12.86 (5.00)	8.96 (2.44)	719
S.Em ±		0.031	0.031	0.70	0.62	28.03
C.D. at 5%		NS	NS	NS	NS	NS
C.V.%		6.43	7.01	8.36	10.76	7.38

Figure in parentheses are original value whereas, those outside are √x + 0.5 *and arcsine transformed values

Conclusion

Significant lowest population of *M. vitrata* and *H. armigera* recorded on crop sown during 4th week of February (late sown) and it was recorded 0.15 and 0.05 larvae per plant, respectively. The study further revealed that sowing of mungbean during 4th week of February (late sown) had significant lowest percent pod damage by *M. vitrata* (5.48%) and *H. armigera* (2.67%) and it was remained at par with 3rd week of February (mid late sown). Moreover, genotype NKM 15-12 was found to be less percent pod damage by *M. vitrata* and *H. armigera*, respectively. The interaction effect of sowing dates and varieties had non-significant influence on *M. vitrata* and *H. armigera* infestation. The mungbean crop sown on 3rd week of February (mid late) recorded significant highest grain yield (703 kg/ha). Thus, results of above findings is indicated that the mid late and late sowing *i.e.* 3rd and 4th week of February is the best sowing time for all the three mungbean varieties/genotype as it has less pest infestation and higher grain yield. The genotype NKM 15-12 and NKM 15-08 have significant least infestation of borers and gave higher yield.

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