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STUDIES ON EFFECT OF WEATHER PARAMETERS ON *KHARIF* GREEN GRAM (*Vigna radiate* L.) VARIETIES UNDER DIFFERENT SOWING DATE

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ABSTRACT

The present investigation was carried out to identify suitable variety and influence of sowing dates on yield of green gram. The field experiment was conducted during *kharif* season of 2016-2017 with green gram variety PKV Green gold- (AKM-9911), PKV Mung-8802 and Kopargaon on field number 10 of Agronomy farm, College of Agriculture, Nagpur. The experiment was laid out in Split Plot Design with nine treatment combinations with four replications consisting three levels of sowing dates *i.e.* 25th MW, 26th MW, 27th MW and three varieties *i.e*. PKV Green gold- (AKM-9911), PKV Mung-8802 and Kopargaon. Various sowing dates significantly influenced the growth and yield of green gram varieties. Sowing of different varieties under different dates significantly influenced the plant height, dry matter accumulation plant^{-1}, number of branches plant^{-1}, days of maturity number of pods plant^{-1}, weight of dry pods plant^{-1}, weight of seeds plant^{-1}, test weight, grain and straw yield (kg ha^{-1}) and harvest index. Among the three cultivars PKV Green gold- (AKM-9911) recorded the higher growth and yield attributing characters which resulted in significantly higher seed yield over the varieties PKV Mung-8802 and Kopargaon. In case of weather parameters, temperature requirement is highest when crop sown on 25th MW than rest of the sowing dates. Green gram varieties was not influenced due to relative humidity. Agro-meteorological sowing of green gram crop on 25th MW was found suitable, while variety PKV Green gold- (AKM-9911) performed better than PKV Mung-8802 and Kopargaon.

(Key words: Green gram, sowing dates, weather parameters)

INTRODUCTION

Sowing time is a nonmonitory input and it is the single most important factor to optimum yield from green gram. The temperature plays an important role on the growth and yield of different crops. The harvesting time of different *kharif* pulse crops varies from middle August to September end. So determination of optimum sowing time for green gram is inevitable which can be adjusted during this period. Optimum sowing time of green gram may vary from variety to variety and season to season due to variation in agro-ecological conditions. Therefore, there must be a specific sowing dates, especially in *kharif* season to obtain maximum yield at lowest economical cost of cultivation. Delayed sowing and early sowing may reduce yield and increase economical cost of cultivation of *kharif* green gram. Mid-June to mid July is found to be optimum time for *kharif s*eason. Early planting in 3rdweek of June results in higher yield and any delay in sowing beyond these dates causes reduction in yield.

Now a days attention also paid on global warming and due to global warming, climatic changes are often observed in India. That's why growth and yield of green gram is greatly affected. To overcome this problem, there is necessity to study the effect of weather parameters on the different varieties of green gram to different sowing time. Among important management factors, sowing time plays a key role in maximizing the yield potential of green gram. The optimum sowing time is mainly dependent on different weather parameters and conditions and varieties used. Variation in seeding dates had a substantial influence on grain yield of green gram. Timely sowing produces taller plants with better yield and yield components.

Yield potential of this crop can be exploited by the use of agronomic techniques. Among them standardized agronomic practices required for realizing yield potential of *kharif* green gram, sowing time and varieties play vital role. In order to bring out country as a whole to a level on which other countries are standing as far as agricultural production is concerned, it is very essential to emphasize on such aspects. Some of the basic principles of factors contributing towards the increase in hectare^{-1} yield of crops such as suitable cultivar with required heritable potentially, proper sowing time and prevalence of congenial weather conditions.

The importance of last factor besides the first two can in the least be underestimated. It is true that prevalence of congenial weathers conditions is the only factor which neutralizes the good heritable potentiality of a variety under

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systematic agronomic practices, low will be obtained if it is grown at improper time.

Recent studies confirm that varieties differ extensively in the physiological processes determining the yield. It has been also shown that the total yield plant^{-1} and unit^{-1} area is determined by the number of pods and seed weight plant^{-1}. These physiological factors also influenced by environmental factors. Keeping this in view, this study was carried out to understand the performance of weather parameters during different sowing dates with varietal response of green gram with the objectives to study the effect of temperature and relative humidity on the growth and development of green gram varieties and to find out the most optimum meteorological week for sowing of green gram.

MATERIALS AND METHODS

The field experiment was laid out in a Split Plot Design with four replications. There were nine treatment combinations comprising of three sowing dates (25th, 26th and 27thMW) and three varieties (PKV Green Gold – (9911), PKV Mung – 8802 and Kopargaon). The gross and net plot size were 3.6 m x 4.8 m and 3.0 m x 4.2 m, respectively. A spacing of 30 cm x 10 cm was adopted by using 12-15 kg seed ha^{-1}. A recommended dose of fertilizer (20:40:00 kg N, P and K ha^{-1}) was applied uniformly to all the treatments. Nitrogen was supplied through urea and phosphorus through single super phosphate. The sowing was done by drilling method as per treatments. The pre harvest biometric observations on plant height (cm) and number of branches plant^{-1} were recorded periodically at 30, 45, 60, days after sowing and at harvest from five representative plants. The post harvest biometric observations were recorded on dry mater at harvest, number of pods plant^{-1}, weight of dry pods plant^{-1} (g), weight of seeds plant^{-1} (g), grain yield ha^{-1} (kg), straw yield ha^{-1} (kg), and harvest index (%) after harvest from five representative plants. The observations on emergence count, final plant stand and test weight of seeds (g) were recorded on plot basis. Weather parameters like temperature requirement (Thermal) of each variety also referred as thermal unit, for each calendar day during crop period, all the treatments were calculated from daily weather data on maximum and minimum temperature as under

$$\text{Thermal requirement} = \frac{T_{Max} + T_{Min}}{2} - T_{Base}$$

Where,

T_{Max} – Maximum temperature
T_{Min} – Minimum temperature
T_{Base} – Base temperature (5 ^{0}C)

Base temperature is the temperature below which the physiological activities in plant practically cease and as a result plant does not show any growth. It present study base temperature for green gram crop was taken as 5 ^{0}C. Further total thermal unit requirement over crop period under each treatment was calculated by summation. Relative humidity for each crop growth period in respect of each treatment were added together so as to obtain relative humidity requirement in percentage during that crop period. Mean relative humidity over crop period under each treatment was calculated by summation. The benefit : cost ratio was worked out by the dividing the gross monetary returns (Rs.ha^{-1}) with total cost of cultivation (Rs.ha^{-1}).

The data collected during the course of investigation was statistically analyzed by adopting standard method known as "Analysis of variance" for split plot design (Panse and Sukhatme, 1971). Wherever the results were found significant, critical difference (C.D.) were worked out at 5 per cent level of probability for comparison of treatment means.

RESULTS AND DISCUSSION

The experimental site was fairly uniform and leveled. The soil analyzed in experimental site have loamy clayey in texture, medium in nitrogen and phosphorus content and rich in potash. Organic carbon content was medium and soil reaction was slightly alkaline (7.7) in nature. The meteorological data presented in table 3 indicated that, there was slightly variation in mean maximum temperature during 2016-2017 as compared to their average. The maximum temperature ranged from 29.1^{0}C to 42.7^{0}C, minimum temperature ranged from 20.0^{0}C to 28.9^{0}C and the morning relative humidity ranges from 41 to 86 per cent and the evening relative humidity ranges from 34 to 76 per cent during the growth period the of crop. The total rainfall during crop period was 908.4 mm. Crop sown on 25thMW and 26th MW experienced favorable temperature and moisture condition showed better germination and crop growth. However, crop sown on 27thMW badly affected due to high rainfall during germination showing poor germination and stunted growth. As the rainfall was high during germination and on seedling phase of the crop sown on 27th MW affected vegetative growth, flowering, pod formation grain filling resulting into low yields. The temperature and moisture condition for the crop sown on the 25th MW and 26th MW were most favorable throughout the cropping period and thus showed better growth and yield.

Plant stand plot^{-1}

Data regarding plant stand of green gram recorded at 12 DAS and at harvest presented in table 1 revealed that emergence count and final plant stand at harvest of green gram as influenced by different sowing dates was statistically non-significant during the investigation. Data revealed that emergence count at 12 DAS and final plant stand at harvest as influenced by varieties of green gram were found to be non-significant during the experiment. Interaction effect due to sowing dates and varieties on emergence count at 12 DAS and final plant stand at harvest was also found to be non-significant during the study.

Plant height

Mean plant height increased with advancement in the age of the crop till harvest. The mean initial plant height was 33.80 cm at 30 days and increased up to 66.22 cm at harvest. The data (Table 1) revealed that the plant height influenced by sowing dates were sown significant at 30DAS.Whereas the plant height recorded at 45, 60 DAS and at harvest found to be significant. The *kharif* green gram sown during 25th MW recorded maximum plant height at harvesting stage (68.58 cm). However, it was at par with26th MW at 45, 60 DAS and at harvest. This might be due to congenial climatic condition for better germination and further growth and development of *kharif* green gram crop. Similar results were reported by Malik *et al.*(2006) recorded maximum plant height in third week of July sowing. Singh *et al*. (2014) noticed that plant height was significantly higher when crop of mungbean was sown on 25th June during both the years 2014 and 2015. The data revealed that height of plant recorded at 45, 60 DAS and at harvest was significantly influenced by different varieties except 30 DAS. The variety PKV Green Gold- (AKM-9911) recorded significantly taller plant height *viz.,* 54.17 cm, 64.17 cm, and 67.83 cm at 45, 60 DAS and at harvest respectively, whereas it was par with variety PKV Mung-8802 at 45, 60 DAS and at harvest. Lowest plant height was recorded by variety Kopargaon. This might be due to genetic characters of PKV Green Gold- (AKM-9911). The similar findings were reported by Abdur *et al.* (2009) who reported that two mung bean varieties i.e. NM-92 and M-1 planted from 1st to 15th April under agroclimatic condition of Peshawar resulted in maximum plant height. Interaction due to sowing dates with varieties was found to be non significant at all the stage of crop growth.

Dry matter accumulation plant^{-1}

Dry matter production of green gram was significantly influenced by different sowing times (Table 1). Data indicated that, sowing taken on 25thMW recorded the significantly higher dry matter accumulation (15.50 g) at harvest of green gram crop than other sowing dates. However, it was at par with 26thMWat harvest. During present investigation it was observed that their was a progressive decrease in dry matter accumulation as sowing was late and lowest dry matter accumulation (10.83 g) was recorded. i.e. sowing taken on 27th MW. Similar to this result Singh *et al.*(2014) observed that dry matter accumulation plant^{-1} was significantly higher when crop was sown on 25th June during both the year 2014 and 2015. However, a variety PKV Green Gold-(AKM-9911) recorded maximum dry matter at harvest (14.08g), but it was at par with variety PKV Mung-8802. However, minimum dry matter accumulation was recorded by variety Kopargaon (12.67g). This was due to the meteorological conditions at that time and plant spread. Similar to this result Joshi and Rahevar (2015) reported higher dry matter accumulation plant^{-1} (g) at 30, 60 and 90 DAS as well as at harvest in the variety Gujrat Val-1 against Gujrat Val-2 of green gram. Interaction effect between sowing dates and varieties was found to be non-significant for dry matter accumulation plant^{-1} at harvest.

Number of branches plant^{-1}

The data presented in table 1 revealed that effect of sowing dates on number of branches plant^{-1} was significant at 45, 60 DAS and at harvest and number of branches plant^{-1} at 30 DAS was found to be non significant. Sowing of green gram at 25th MW produced maximum number of branches (7.00) and revealed that the number of branches was significantly affected due to different sowing dates. However, it was at par with the sowing at 45, 60 DAS and at harvest. In accordance to this result Panotra *et al.* (2016) reported that among different sowing dates in black gram, the sowing at 15th August was found optimum for achieving higher number of branches plant^{-1}. Singh *et al.* (2014) observed that number of branches plant^{-1} was significantly higher when crop was sown on 25th June during both the year 2014 and 2015. The effect of varieties on number of branches plant^{-1} was significant at 45, 60 DAS and at harvest except at 30 DAS. The higher number of branches produced with PKV Green Gold-(AKM-9911) variety (6.92), but it was at par with variety PKV Mung-8802 at 45, 60, DAS and at harvest. Lowest number of branches were recorded by variety Kopargaon at all the growth stages of crop growth. This might be due to varietal performance to *kharif* growing period. These results are in accordance with those reported by Rasul *et al.* (2012), who concluded that mung bean variety NM- 98 grown at inter row spacing of 30 cm recorded maximum number of branches plant^{-1}. Interaction effect between sowing dates with varieties was found to be non-significant at all stages of crop growth.

Days to maturity

The days to maturity was significantly influenced due to varieties and sowing dates. The data revealed that the mean days to maturity was 70.94. It was significantly influenced by different sowing dates. Sowing during 25thMW recorded minimum maturity duration (69.00) but it was at par with 26th MW and maximum for 27thMW i.e.72.67 days. The different varieties were significantly influenced. Variety PKV Green Gold-(AKM-9911) (V_1) recorded minimum days of maturity (69.83), whereas it was at par with variety PKV Mung-8802(V_2) and maximum days of maturity recorded by variety Kopargaon (V_3) (72.08). This was due to the meteorological condition at that time and genetic factor of those varieties. Similar finding were reported by Singh *et al.* (2014), who observed that days to maturity was less when crop was sown on 25th June during both the year 2014 and 2015. The interaction between sowing dates and varieties was non significant in respect of days of maturity.

Number of pods plant^{-1}

The data pertaining to number of pods plant^{-1} at harvest as influenced by different treatments are presented in table 1. The number of pods plant^{-1} at harvest was significantly influenced due to varieties and sowing times. The data presented in table 1 revealed that the mean number of pods plant^{-1} at harvest was 22.97. Sowing taken on 25th MW had recorded significantly higher number of pods (24.08) than other sowing dates, but it was at par with 26th

MW. Late sowing recorded significantly lower number of pods. Subsequent late in sowing resulted reduction in total number of pods plant^{-1}. Similar results were observed by Ali *et al.* (2014), who reported that the higher number of pods plant^{-1} was obtained in 15th June sowing time over rest of the sowing times. They also reported that delay in sowing of mung bean negatively influenced its number of pods plant^{-1} therefore, early sowing 15th June produced higher number of pods plant^{-1} (29.90) and late sowing 15thJuly produced lower number of pods plant^{-1} (13.59). The data pertaining to number of pods plant^{-1} at harvest was significantly influenced by different varieties. A variety PKV Green Gold-(AKM-9911) recorded maximum number of pods plant^{-1} (24.00) which was at par with variety PKV Mung-8802 and lowest number of pods plant^{-1} was recorded by variety Kopargaon (21.75). This has indicated that, the significant difference in number of pods plant^{-1} due to different green gram varieties was more or less due to variety or might be due to genetic makeup of cultivar. Similar finding were reported by Samant (2014), who reported that among different varieties, OBGG 52 recorded maximum number of pods plant^{-1} (30.6). .The interaction between sowing times and varieties was found to be non significant in respect of number of pods plant^{-1} at harvest.

Weight of dry pods plant^{-1}(g)

The data pertaining to weight of dry pods plant^{-1} as influenced by different treatments are presented in table 1. The weight of dry pods plant^{-1} was significantly influenced due to sowing dates and varieties. The mean number of dry pods plant^{-1} at harvest was 8.91(g).The weight of dry pods plant^{-1}(g) significantly influenced by different sowing dates. Sowing during 25th MW recorded maximum weight of dry pods plant^{-1} (9.58g) which was at par with 26th MW and lowest dry pods plant^{-1}was recorded by 27th MW. This was due to low flower drop and more fruit setting during *kharif* season. The data presented in table 1 revealed that variety PKV Green Gold- (AKM-9911) recorded significantly maximum weight of dry pods plant^{-1} (9.50g) whereas, it was at par with variety PKV Mung- 8802 and minimum weight of dry pods plant^{-1} recorded by variety Kopargaon (8.17g).The interaction effect between sowing dates and varieties was found to be non significant for weight of dry pods plant^{-1} at harvest.

Weight of seeds plant^{-1} (g)

The weight of seeds plant^{-1} was significantly influenced due to sowing dates and varieties. The data pertaining to mean weight of seeds plant^{-1} as influenced significantly by different sowing dates are presented in table 1. Sowing taken on 25th MW had recorded significantly higher weight of seeds plant^{-1} (6.67g) whereas, it was at par with 26th MW. This was due to low flower drop and more fruit setting during this season. In accordance to this result, Singh *et al*. (2014) supported the favorable effect of sowing times on weight of seeds in green gram. Their results revealed that weight of seeds plant^{-1} was noticed to be significantly higher when crop was sown on 25th June during both the year 2014 and 2015. The data pertaining to mean weight of seeds plant^{-1} as influenced by different varieties revealed that variety PKV Green Gold- (AKM-9911) recorded maximum weight of seeds (6.33g) and it was found to be at par with variety PKV Mung-8802 and lowest weight of seeds plant^{-1} recorded by variety Kopargaon. This was due to more number of branches plant^{-1} that helped in production of more number of matured or reproductive pods. In accordance to this result Joshi and Rahevar (2015) reported that the higher value of weight of seeds plant^{-1} were noticed by the variety Gujrat Val-1 against Gujrat Val-2. The interaction effect between sowing dates and varieties was found be non significant for weight of seeds plant^{-1} (g) at harvest.

Test weight (g)

Thousand seed weight was influenced by sowing dates and varieties in green gram. The mean thousand seed weight was 40.86 g. Sowing of green gram during 25th MW significantly influenced mean thousand seed weight. Sowing at 25th MW (41.83g) increased number of pods thereby thousand seed weight, whereas it was at par with 26th MW (41.00g). Lowest test weight (39.75g) was recorded under 27th MW. Similar to this results Singh *et al.* (2014) noticed significantly higher 1000 grain weight when crop was sown on 25th June during both the year 2014 and 2015. Abdur *et al*. (2009) also concluded from the experiment that mung bean could be planted from 1st to 15th April under agroclimatic condition of Peshawar for obtaining maximum Thousand seed weight. Thousand seed weight was influenced significantly by different varieties of green gram. The mean thousand seed weight of PKV Green Gold-(AKM-9911) variety was (41.75g).Whereas, it was at par with variety PKV Mung-8802 (40.83g).Lowest test weight (40.00 g) was recorded under variety Kopargaon. Similar to this result Gorade *et al*. (2014) reported significant influence of varieties of green gram and found that variety Phule mung-2 when grown during summer season recorded maximum test weight (g). The interaction effect between sowing dates and varieties was found to be non significant for test weight (g) at harvest.

Grain yield (kg ha^{-1})

The data presented in table 1 indicated that mean grain yield was 779.44 kg ha^{-1}. Grain yield was affected by different treatments. Sowing at 25th MW had recorded significantly higher grain yield (836.92 kg ha^{-1}) as compared to 27th MW. However, it was at par with sowing done on 26th MW. This is due to the higher number of pods plant^{-1}, weight of seeds plant^{-1} and thousand seed weight. Similar results were observed by Ali *et al*. (2014) in mung bean. Their results showed that seed yield was significantly affected by sowing dates. The maximum seed yield (1181.67 kg ha^{-1}) was obtained in 15th June sowing time because of significantly higher number of pods plant^{-1} and 1000 seed weight than rest of the sowing times. Delay in sowing of mung bean negatively influenced its number of pods plant^{-1} therefore,

early sowing 15th June produced higher number of pods plant^{-1} (29.90) and late sowing 15thJuly produced lower number of pods plant^{-1} (13.59). Data presented in table 1 revealed that variety PKV Green Gold- (AKM-9911) had recorded significantly higher seed yield as compared to variety Kopargaon. Whereas, it was at par with variety PKV Mung-8802.This was due to the higher number of pods plant^{-1}, weight of seeds plant^{-1} and thousand seed weight of PKV Green Gold- (AKM-9911) variety. Similar to this results Singh *et al.* (2014) reported that amongst the genotypes, Pant mung-2 gave maximum seed yield (1182 and 1178 kg ha^{-1}) followed by PDM-54 (1125 and 1137 kg ha^{-1}) and K-851 (1068 and 1070 kg ha^{-1}) during 2004 and 2005 respectively in mung bean (*Phaseolus radiatus*). The interaction effect between sowing dates and varieties was found to be non significant for grain yield (kg ha^{-1}) at harvest.

Straw yield (kg ha^{-1})

Data in respect of straw yield (kg ha^{-1}) as influenced by different treatments are presented in table 1. Sowing taken on 25th MW had recorded significantly higher straw yield (1446.50 kg ha^{-1}) than 27th MW and it was at par with 26th MW (1441.25). Lowest straw yield (1361.50 kg ha^{-1}) was recorded under 27th MW. This was due to the production of more number of pods and branches plant^{-1}. In accordance to this result Singh *et al.* (2014) reported that grain and straw yield noticed significantly higher when crop was sown on 25th June during both the year 2014 and 2015 in mung bean. Data also revealed that variety PKV Green Gold-(AKM-9911) produced significantly higher straw yield (1445.00 kg ha^{-1}) as compared to variety Kopargaon, whereas it was at par with variety PKV Mung-8802. This might be due to more plant height, number of branches, number of leaves and pods contributed towards increase in straw yield. Similar to this results Panotra *et al*. (2016) observed significant differences among the varieties in blackgram and variety PU-35 was found highly productive for straw yield as compared to T-9 and PU-19. The interaction effect between sowing dates and varieties was found to be non significant for straw yield (kg ha^{-1}) at harvest.

Harvest index (%)

The mean harvest index was 35.40 per cent. The data revealed that sowing on 25th MW recorded comparatively higher harvest index (36.65%) as compared to all other sowing dates. The harvest index was comparatively higher in green gram variety PKV Green Gold-(AKM-9911) (36.56%) than varieties Kopargaon and PKV Mung- 8802. Similar to this results Sarkar *et al.* (2004) concluded that variety BARI Mung-2 planted on 03rd February at plant density of 30 cm x 10 cm significantly produced the highest seed yield and harvest index and the lowest seed yield and harvest index were found in the variety BARI Mung-3 planted on 20th March at a plant density of 40 cm x30 cm.

Effect of temperature on each variety (^{0}C) of green gram as influenced by sowing dates (Thermal requirement)

Temperature requirement of green gram is actually work out and data are presented in table-2. Sowing in 25th MW recorded highest temperature requirement (1518.67^{0}C) and sowing in 27th MW (1407.58^{0}C) recorded lowest temperature requirement. In accordance to these findings Devidas *et al.* (2014) from his field experiment carried out during *kharif* season 2011 with the objective to study the thermal requirement and yield of mungbean genotypes observed that early sowing (July 20) resulted in absorbing sufficient amount of heat unit in less time as compared to late sowing (9th August) which acquired more days to mature and resulted in accumulation of more growing degree days (GDD) as compared to early date of sowing. The different varieties recorded different temperature requirement, variety PKV Green Gold-(AKM-9911) recorded highest temperature requirement followed by variety PKV Mung- 8802 and Kopargaon.

Effect of relative humidity on each variety of green gram as influenced by sowing dates

The data on relative humidity requirement are presented in table 3. The relative humidity requirement for *kharif* green gram was calculated by using average relative humidity during crop period. As regard effect of sowing dates on relative humidity requirement of crop the variation in maximum and minimum relative humidity during first two sowing dates was similar, however sowing in 27 MW the variation in relative humidity was less as compared earlier two sowing dates. This indicates that sowing of green gram variety was not influenced due to relative humidity. The different variety were not influenced due to relative humidity on the growth and development during crop period.

B: C ratio

Mean B: C ratio of green gram crop obtained was 3.02. Highest B: C ratio (3.23) was recorded with sowing on 25th MW as compared to other sowing dates. Increase in B:C ratio is due to significant increase in gross monetary return. Comparatively higher B:C ratio of 3.22 was recorded with variety PKV Green Gold-(AKM-9911) over PKV Mung-8802.

Sowing of green gram during 25th MW significantly improved all the growth and yield components as compared to sowing of green gram during 26th, and 27th MW resulted in significant increase in grain yield of green gram. Among the three different cultivars of green gram, PKV Green Gold – (9911) recorded significantly higher growth and yield components resulting in increase in grain yield as compared to PKV Mung – 8802 and Kopargaon . The temperature requirement of green gram varieties sown in 25th MW was higher. Among the varieties PKV- Green Gold was required higher temperature. Sowing of green gram varieties was not influenced due to relative humidity.

Table 1. Effect of sowingdates and varieties on different traits

Treatments	Emergence count	Final plant stand	Plant Height (cm) 30 DAS	45 DAS	60 DAS	At harvest	Dry matter at harvest	Number of branches plant^{-1} 30 DAS	45 DAS	60 DAS	At harvest	Days to maturity
Sowing Dates												
S_1: 25th MW	415.00	411.58	35.17	54.42	64.50	68.58	15.50	3.08	5.50	6.58	7.00	69.00
S_2: 26th MW	412.17	409.92	33.33	53.33	63.67	67.33	14.25	2.83	5.25	6.25	6.75	71.17
S_3: 27th MW	410.75	407.83	32.92	49.92	59.58	62.75	10.83	2.33	4.42	5.08	5.58	72.67
SE(m) ±	**1.02**	**0.91**	**0.53**	**0.40**	**0.31**	**0.40**	**0.42**	**0.18**	**0.12**	**0.12**	**0.12**	**0.45**
CD at 5%	-	-	-	**1.20**	**0.93**	**1.20**	**1.26**	-	**0.36**	**0.36**	**0.36**	**1.35**
Varieties												
V_1: PKV Green Gold-(AKM-9911)	414.08	411.67	35.00	54.17	64.17	67.83	14.08	3.00	5.42	6.50	6.92	69.83
V_2: PKV Mung-8802	412.50	410.00	34.08	53.08	62.92	66.83	13.83	2.92	5.08	6.17	6.67	70.92
V_3: Kopargaon	411.33	407.67	32.33	50.42	60.67	64.00	12.67	2.33	4.67	5.25	5.75	72.08
SE(m) ±	**0.73**	**1.03**	**0.73**	**0.40**	**0.44**	**0.44**	**0.34**	**0.20**	**0.17**	**0.14**	**0.13**	**0.44**
CD at 5%	-	-	-	**1.21**	**1.32**	**1.32**	**1.02**	-	**0.51**	**0.42**	**0.39**	**1.32**
Interaction												
SE(m) ±	**1.27**	**1.86**	**1.27**	**0.70**	**0.77**	**0.77**	**0.60**	**0.36**	**0.30**	**0.25**	**0.24**	**0.77**
CD at 5%	-	-	-	-	-	-	-	-	-	-	-	-
G.M.	412.63	409.77	33.80	52.55	62.58	66.22	13.52	2.74	5.05	5.97	6.44	70.94

Treatments	Number of pods plant^{-1}	Weight of dry pods plant^{-1}(g)	Weight of seeds plant^{-1} (g)	Test Weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest Index (%)	B:C ratio
Sowing Dates								
S_1: 25th MW	24.08	9.58	6.67	41.83	836.92	1446.50	36.65	3.23
S_2: 26th MW	23.25	9.17	6.42	41.00	832.17	1441.25	36.60	3.21
S_3: 27th MW	21.58	8.00	5.00	39.75	669.25	1361.50	32.95	2.64
SE(m) ±	**0.26**	**0.17**	**0.09**	**0.30**	**1.44**	**1.98**	-	-
CD at 5%	**0.78**	**0.51**	**0.27**	**0.90**	**4.32**	**5.94**	-	-
Varieties								
V_1: PKV Green Gold-(AKM-9911)	24.00	9.50	6.33	41.75	833.00	1445.00	36.56	3.22
V_2: PKV Mung-8802	23.17	9.08	6.17	40.83	829.00	1440.17	36.53	3.20
V_3: Kopargaon	21.75	8.17	5.58	40.00	676.33	1364.08	33.14	2.66
SE(m) ±	**0.29**	**0.16**	**0.13**	**0.34**	**1.60**	**1.93**	-	-
CD at 5%	**0.87**	**0.48**	**0.39**	**1.01**	**4.76**	**5.79**	-	-
Interaction								
SE(m) ±	**0.51**	**0.28**	**0.24**	**0.59**	**2.77**	**3.35**	-	-
CD at 5%	-	-	-	-	-	-	-	-
G.M.	22.97	8.91	6.02	40.86	779.44	1416.41	35.40	3.02

Table 2. Effect of temperature on each variety of *kharif* greengram as nfluenced by different treatments (Thermal requirement)

Treatments	Temperature (Thermal) requirement (^{0}C)
Sowing dates	
S_1: 25th MW	1518.67
S_2: 26th MW	1432.92
S_3: 27th MW	1407.58
Varieties	
V_1:PKV Green Gold-(AKM-9911)	1489.17
V_2:PKV Mung- 8802	1443.50
V_3:Kopargaon	1426.50
G M	1453.05

Table 3. Sesaonal variation in humidity during crop period

Meteorological Week	Relative Humidity (%)		
	Maximum	Minimum	Variation
25(1st Sowing)	74	58	16
26(2nd Sowing)	81	49	32
27(3rd Sowing)	86	76	10
28	83	72	11
29	84	71	13
30	82	70	12
31	86	73	13
32	81	70	11
33	74	60	14
34	76	56	20
35	81	75	06
36	85	62	23
37(1st Harvesting)	83	72	11
38(2nd Harvesting)	81	63	18
39(3rd Harvesting)	85	70	15

REFERENCES

Abdur, R., S. K. Khalil, S. Nigar, S. Rahman, I. Haq, S. Akhtar, A. Z. Khan, and S. R. Shah, 2009. Phenology, plant height and yield of Mungbean varieties in response to planting date. Sarhad J. Agric.**25**(2).

Ali Saif, T. Khaliq, A. Ahmad, R. Muzammal , S. Hussain , K. Rehman and M. V. Parvez, 2014. Genotypic variation in mungbean yield and its attributes in response to different sowing times. Res. J. Agric. Environ. Management, **3**(5): 255-258.

Joshi, S. K. and H. Rahevar, 2015. Effect of dates of sowing, row spacings and varieties on growth and yield attributes of *rabi* Indian bean (*Dolichos lablab* L.). Indian J. Agric. Res. **49**(1): 59-64.

Malik, A.M., M.F. Saleem, A. Ali and R.A.F. Ishaq, 2006. Effect of sowing dates and planting patterns on growth and yield of mung bean. J. Agric. Res. **44**:139-146.

Panotra, N., Ashwani Kumar and O.P. Singh, 2016. Effect of varieties and dates of sowing on growth parameters, yield attributes & yield of black gram. Int. J. Sci. Env. Tech. **5**(6): 3821-3826.

Rasul, F., M. A. Cheema, A. Sattar, M. F. Saleem and M. A. Wahid, 2012.Evaluating the performance of three mungbean varieties grown under varying inter-row spacing. The J. Animal Plant Sci. **22**(4):1030-1035.

Samant, T.K. 2014.Evaluation of growth and yield parameter of green gram (*Vigna radiate* L.).Hind Agriculture Research and Training Institute. Agric. Update, **9**(3): 427-430.

Sarkar md, A. R., Md. Hasan Kabir, Mahfuza Begum and Md. Abdus Salam, 2004. Yield performance of mungbean as affected by planting date, variety and plant density. J. Agron. **3** (1): 18-24.

Singh, M. and R. Kumar, 2014. Effect of date of sowing and seed rate on the growth of *kharif* mash (*Vigna mungo* L.) and yield. Agric. Sci. Digest, **34**(3): 211-214.

Singh, M., N. S. Rana, Satyaprakash, Adesh Singh and B. P. Dhyani, 2014. Growth and yield behavior of mung bean genotype (*Phaseolus radiatus* L.) under different dates of sowing and effect of soil health. Agriways, **2**(1): 28-34.

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