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Research Article

Influence of Sowing Date on Phenology, Biometric, and Yield of Mungbean (*Vigna radiata*) Cultivars in Chitwan, Nepal

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Mungbean is a commercially promising legume crop, accounting for a very low productivity of approximately 0.5 tons ha^{1} in the Terai region of Nepal. This study aimed to achieve the potential yield of mungbean promising cultivars planting at optimum sowing time. An experiment was conducted at the Agriculture and Forestry University (AFU), Rampur, Chitwan, during the spring of 2019 in a split-plot design (SPD) with three replications and 16 treatment combinations. Four sowing dates at 15 days intervals (13th February, 28th February, 15th March, and 30th March) of 2019; cultivars viz. Kalyan, Pratikshya, Pratigya, and Pant-5 are considered as main and subplot factors. The Dunken test was carried out to compare the mean in R-software at $p \leq 0.05$ level of significance. The results revealed that earlier planting (Feb 13 planting) resulted in delayed emergence, slower growth, and the lowest yield (1.79 tons/ha). The March 15 to March 30 plantations resulted in significantly faster emergence, germination, and growth showing a higher yield. Pant-5 yielded a higher grain yield, which was statistically at par with Partigya (2.08 tons/ha) and Partikshya (1.983 tons/ha). Vigna radiata plantations from March 15 to March 30 are the optimum sowing times for higher productivity (2.119 tons/hectare) and high potential yield, which can be applied for perfect decision-making in mungbean plantations. Future work on least-squares analysis for understanding the genotypic-environment interaction of economic traits and the effect of different nutrient sources on cultivars has scope.

1. Introduction

Mungbean (*Vigna radiata* (L.) *Wilczek var. radiata*), also known as Green gram or moong, is a commercially promising legume in the Terai region of Nepal [1]. The majority of the mungbean area—more than 75%—is situated in the eastern and central Terai, where irrigation is possible, and the other 25% is in the west Terai and foothills [2]. The estimated area under mungbean is about 12,000 ha with a production of 6,500 metric tons and productivity of 500 kg·ha^{-1} [3]. The share of mungbeans in the area of grain legumes is approximately 4% [4–6]. The potential yield of mungbean can be achieved through the optimum use of inputs and agronomic practices [7]. High-yielding varieties and suitable sowing times are the most important factors affecting yield. One of the most crucial agronomic variables for maximizing the yield potential of improved cultivars is choosing the right time to sow the crop because it facilitates total harmony between the vegetative and reproductive stages of the plant [8]. Therefore, sowing the crop at the optimum time plays a key role in obtaining high seed yields [9]. The optimum sowing time is mainly dependent on the prevailing agroclimatic conditions of an area beside the cultivar grown [10]. Planting during an optimum period with suitable highly adapted cultivars ensures better harmony between the plant and the weather which ultimately results in a higher yield [11]. Early sowing may result in poor germination and poor plant stands, whereas yield from very late sown crops may be low due to unfavorable agroclimatic conditions for the growth and development of mungbean in subtropical areas characterized by high temperatures and heavy rainfall during the summer season (April to September) [12]. Delayed sowing after March may cause rain damage during maturity [13]. Therefore, there must be specific sowing dates, especially in the summer season for different cultivars to obtain the maximum yield [14].

Cultivars play an important role in determining crop yield potential [8, 10]. The potential yield of cultivars within their genetic limit is determined by their environment [15]. Varieties differ in their yield potential depending on many physiological processes that are controlled by both genetic makeup and the environment [16]. Mungbean productivity can be achieved efficiently with the selection of superior genotypes which is a prerequisite, possessing better heritability and genetic advance for various traits [17]. If high-yielding varieties are chosen and planted at the right time of year, yield can be boosted more [18].

There are very few or negligible studies on the varietal development of mungbean in Nepal [18]. Only, 4 varieties of mungbean have been released to date viz. Pusha Baisakhi, Kalyan, Pratikshya, and Pratigya (Hum-16) [2]. Kalyan, Pratikshya, and Pratigya were given to the superior genotypes brought from IVRDC [19]. These lines are suitable for rice-based and maize-based systems, resistant to MYMV and CLS (Cercospora leaf spot) and have semisynchronous maturity (85% of the pod is harvested after two pickings) [20]. A few promising genotypes, including VC 6173(B-10), VC 6368 (46-40-4), NIMB101, Bari mung, and VC 6153B-20G, had up to 50% larger seeds and a yield that was around 25% greater than Saptari Local (maturity was about 65 days) [21]. Bari mung and NIMB 101 are resistant to MYMV [18]. So cultivation of these Cultivars from March 15 to March 30 might also have better yield because they are resistant to mungbean yellow mosaic virus (MYMV) and CLS.

Hence, there is a need to enhance the productivity of mungbean by adopting proper agronomic practices like dates of sowing and nutrient management apart from evolving new high-yielding cultivars [22, 23]. The introduction of such high-yielding cultivars has provided the scope for improving the overall productivity of the mungbean [8, 24].

This experiment aims to determine the relation of planting time and varieties with phenological, biometric, yield attributing traits, and yield of mungbeans to guide the best planting time. This study hypothesized that variable sowing dates and cultivars can have differential responses in terms of growth and seed production. Keeping these factors in view, the present study was designed to find out the proper date of sowing for the high gain yield of different mungbean cultivars.

2. Materials and Method

The experimental field, AFU, was located in the inner Terai of central Nepal has subtropical humid weather and climate from the 2nd week of February to the 3rd week of June (Figure 1).

2.1. Climatic Conditions During Experimentation. The mean data of different weather parameters i.e., average relative humidity, maximum and minimum temperature, and the total rainfall during the growing season of mungbean at NMRP are presented at a monthly interval in Figure 2. Two irrigations were done during the critical stage of crop.

2.2. Experimental Design. The experiment was laid out in split-plot design (SPD) with three replications having 16 treatment combinations. The main plot factor consisted of four sowing dates at 15 days intervals (13th February 2109, 28th February 2019, 15th March 2019, and 30th March 2019) and the subplot factor consisted of four cultivars viz. Kalyan, Pratikshya, Pratigya, and Pant-5. The size of the individual plot was $4\,m \times 2\,m$ ($8\,m^2$)Figure 3**.**

Spacing, experimental plot to plot distance, and replications distance were $(40 \times 10)\,cm^2$, 0.5 m, and 1.0 m, respectively. The individual plot contained 10 rows and the outer two rows were used as border rows. Inner adjacent two rows from one border were used for destructive or sampling rows and after two sampling rows next were also used as the inner border. Sampling was done by excluding the peripheral effect for the next sampling. The five rows ($4\,m^2$) from the other border row were harvested as net plot rows. Six plants were tagged from net plot rows and were used to take biometric data.

After the first plowing, well-rotten farm yard manure (FYM) was applied@ at 10 tons·ha^{-1} and mixed them in the soil thoroughly. After the final preparation of the field, the experiment was laid out as per Figure 2. All recommended doses of chemical fertilizers (20 : 40 : 20 kg NPK ha^{-1}) were crossed wise broadcasted and incorporated as basal doses at the time of sowing. The source of nitrogen was urea (46% N) and phosphorus through DAP (18 : 46 : 0%-$N_2 : P_2O : K_2O$), and the source of potassium was murate of potash (60% K_2O). Pods were sun dried on the threshing floor for a week. Net plot areas were harvested manually by picking when 75% of plants showed brown color pods (physiological maturity). Second and subsequent picking and harvesting were done at seven to ten days intervals Threshing was manually done by beating the pods with a stick and trampling by feet. Grain was cleaned by winnowing and dried to reduce the seed moisture content by up to 11%.

2.3. Characteristics of Treated Cultivars

(i) Kalyan: This cultivar shows plant height 32 (22–45 cm), days to flowering 40 (36–46), days to first picking 60 (53–68), and average yield 1364 (134–1825 kg/ha). Similarly, yield attributing characteristics are pods/plant, seeds/pod, and test weight and several picking days needed are 14 (11–17), 10 (9-10), 48 (42–54), and 3, respectively.

(ii) Pratikshya: This cultivar has a plant height of 43 cm, days to flowering 43, days to first picking 63, and yield range of 700–1539 kg/ha. Similarly, yield attributing characteristics are pods/plants. Seeds/pod and the number of picking needed are 15, 10, and 3, respectively. NARC, 2010 reported that Pratikshya (1.347 t/ha) was released in 2006 and recommended in Terai, inner Terai, and foothills of Nepal from 100 to 700 meters above sea level (masl).

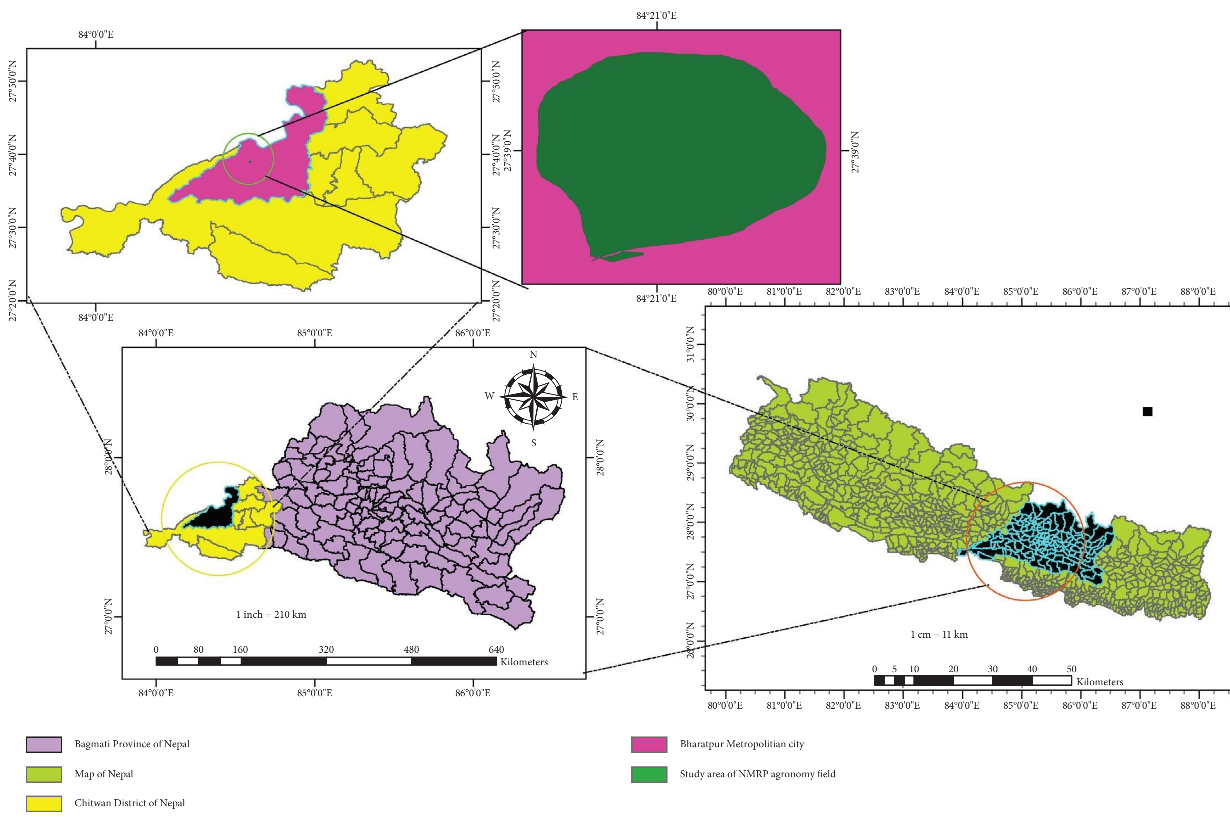

Figure 1: GIS map of study area of Chitwan-NMRP-AFU agronomic research field (North South, East and West).

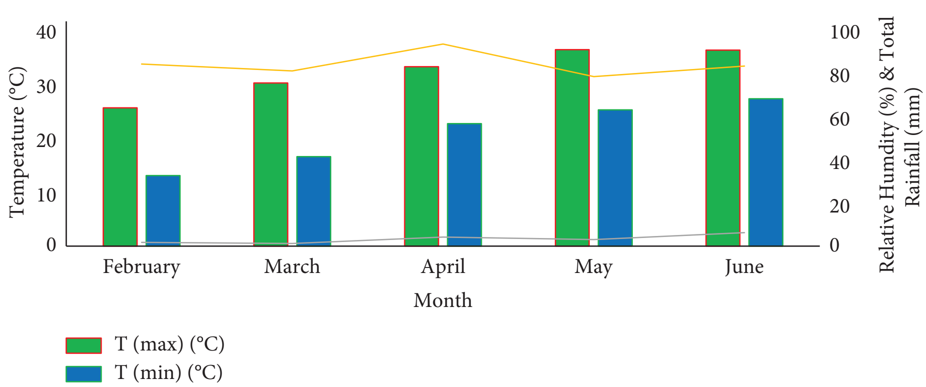

Figure 2: Weather and climatic conditions during experimentation at NMRP, Rampur, Chitwan, 2019.

(iii) Pratigya (Hum-16): This variety shows a plant height of 40 cm, days to flowering 46, days to first picking 65, and yield range of 1347–2224 kg/ha. Similarly, yield attributing characteristics are pods/plant and seeds/pod and the number of picking needed are 17, 10, and 2, respectively. NARC, 2020 reported Partigya (1.347 t/ha) was released in 2019 and recommended in Terai, inner Terai, and foothills of Nepal from 100 to 700 masl.

(iv) Pant-5: plant height 45 cm, days to flowering 38, days to first picking 63, yield range 1486 (1618–1972 kg/ha). Similarly, yield attributing characteristics are pods plant seeds/pod and number of picking days needed were 21, 9, and 3, respectively. It is one of the promising pipeline mungbean varieties of NARC under the outreach research program carried out by National Grain Legume Research Programme.

2.4. Data Collection and Analysis. "Phenological traits such as emergence, trifoliate, flowering, pod formation, physiological, and harvest maturity were obtained from the whole plot where 75% of plants showed such characters, whereas yield and yield attributing traits and final grain yield were adjusted at 10% moisture level by using the following formula shown in equation (1). The harvest index was

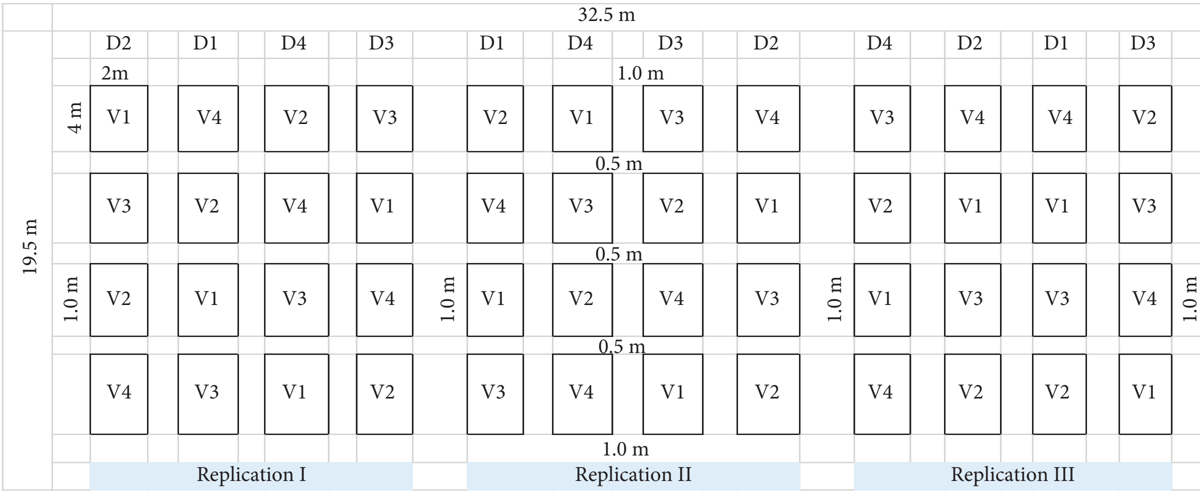

Figure 3: The layout design of experimental plots with ten rows and 12 spots per row, spaced 40 cm row to row, and 10 cm plant to plant.

calculated by dividing economic yield by biological yield ($kg{\cdot}ha^{-1}$) and expressed in percentage. The shelling percentage was calculated from the pods' weight. It is the ratio of the weight of grain to the weight of pods.

$$\text{Shelling percentage}\,(\text{kg ha} - 1) = \frac{\text{Weight of grains}}{\text{Weight of pods}} \times 100. \qquad (1)$$

2.5. Statistical Analysis. The mean collected data were spread in the MS Excel sheet and subjected to analysis of variance, and R-Studio package version R-4.2.2 was used for data analysis. A significant result was separated at a ($p < 0.05$) level of significance by Duncan's multiple range test (DMRT).

3. Result and Discussion

3.1. Phenological Traits. Phenological states such as 75% emergence, trifoliate, and flowering stages significantly differed due to different planting dates shown in Table 1. Earlier sowing resulted in delayed emergence, flowering, and pod formation stages while reaching the earliest physiological and harvest maturity. Rehman et al. (2009) reported March 30 sowing i.e., earlier sowing took more days to flower. Evaluated cultivars have shown the same maturity stage; however, pod formation stage differed only in Table 1.

75% of pod formation, physiological, and harvest maturity significantly differed due to different planting dates shown in Table 2. Cultivars do not influence the physiological maturity and harvest maturity at 75% of the phenological stage in these climatic conditions.

3.2. Biometric Traits. Studied biometric traits were found to be significantly different in terms of sowing date however no difference in the case of the cultivar used. As compared to Feb 13, March 30 planting yielded a greater number of leaves, the highest plant height, and the highest above-ground dry matter. A study reported significant differences in plant height due to various planting dates and cultivars used [13]. Miah et al. (2009) reported Feb 20 resulted in the lowest plant height. Several leaves, plant height, and above-ground dry matter% are highly significant with the date of planting. The superior trait is found on March 30 plantation Table 3.

3.3. Yield Attributing Characters. All studied yield attributing traits significantly differed except for several plants ha^{-1}. The effect of sowing dates on plant population was nonsignificant. The effect of cultivars on the number of plant populations per hectare at harvest of mungbean was also nonsignificant. The number of clusters per plant was significantly affected by sowing dates. The mean number of clusters per plant for total picking was found at 8.93 and it ranged from 7.05 on the 13th of February sowing to 9.69 on the 30th of March sowing of mungbean. The number of clusters per plant during total plucking was shown to be unaffected by cultivars. Similarly, the interaction effect of the date of sowing and cultivars was found nonsignificant to the number of clusters per plant for total picking. The number of pods per plant was significantly affected by sowing dates.

The mean number of pods per plant for total picking was found 19.4 and it ranged from 18.72 on the 13th of February sowing to 20.11 on the 30th of March sowing of mungbeans. The effect of cultivars on several pods per plant for total picking was found nonsignificant. Similarly, the interaction effect of the date of sowing and cultivars was found nonsignificant to several pods per plant for total picking. Maturity decreased with delay in sowing time pods per plant also decrease in delay sowing [7]. Pod length was significantly affected by both sowing dates and varieties. The mean pod length was 9.06 cm and it ranged from 8.82 cm to 9.54 cm. The pod length of mungbeans was significantly influenced by planting time [8]. Singh and Singh (2009) reported that 15th March sowing resulted in the highest pod length than 24th February. Seeds per pod were significantly affected by both sowing dates and varieties. The mean

Table 1: Effect of different sowing dates and selected cultivars on phenological stages of spring mungbean at AFU, Rampur, Chitwan, 2019.

Treatment	Days to 75% phenological stages		
	Emergence	Trifoliate	Flowering
Date of planting (D)			
D1 = February-13	6.58[a]	20.96[a]	57.17[a]
D2 = February-28	5.21[b]	18.04[b]	50.42[b]
D3 = March-15	5.17[b]	16.08[c]	42.75[c]
D4 = March-30	4.13[c]	12.96[d]	39.00[c]
SEm (±)	0.21	0.60	1.82
LSD (0.05)	0.51**	1.47**	4.45**
CV (%)	4.90	4.30	4.70
Cultivars (V)			
V1 = Kalyan	5.25[ab]	16.79[b]	46.58 [b]
V2 = Partikshya	5.46[a]	17.67[a]	48.50[a]
V3 = Partigya	5.42[a]	17.04[ab]	47.83[ab]
*V*4 = Pant-5	4.96[b]	16.54[b]	46.42[b]
SEM (±)	0.18	0.40	0.81
LSD (0.05)	0.38*	0.81*	1.68*
CV (%)	8.60	5.60	4.20
Grand mean	5.27	17.01	47.33

Treatment mean followed by common letters within the same column are not significantly different from each other based on DMRT at a 5% level of significance.

Table 2: Effect of different sowing dates and selected cultivars on phenological stages of spring mungbean at AFU, Rampur, Chitwan, 2019.

Treatment	Days to 75% phenological stages		
	Pod formation	Physiological maturity	Harvest maturity
D1 = February-13	63.25[a]	68.33[a]	76.58[a]
D2 = February-28	57.83[b]	62.67[b]	69.83[b]
D3 = March-15	49.58[c]	57.67[c]	64.33[c]
D4 = March-30	45.83[c]	53.08[c]	60.42[d]
SEm (±)	1.86	1.91	1.49
LSD (0.05)	4.55**	4.68**	3.63**
CV (%)	4.20	3.90	2.70
Cultivars (V)			
*V*1 = Kalyan	53.33[b]	60.08[a]	67.42[a]
*V*2 = Partikshya	55.75[a]	61.67[a]	69.08[a]
*V*3 = Partigya	54.25[ab]	60.58[a]	68.17[a]
*V*4 = Pant-5	53.17[b]	59.42[a]	66.50[a]
SEM (±)	0.95	1.19	1.56
LSD (0.05)	1.95*	Ns	ns
CV (%)	4.30	4.80	5.70
Grand mean	54.13	60.44	67.79

Treatment mean followed by common letters within the same column are not significantly different from each other based on DMRT at a 5% level of significance.

number of seeds per pod was 9.66 and it ranged from 9.33 to 10.04 (Table 4). Ahmed et al. (2021) reported significant differences in grain per pod due to different sowing dates and cultivars used (similar microclimate condition), which is according to our findings. Sowing dates had a considerable impact on thousand-grain weight. The mean number of thousand-grain weight was 44.83 g and it ranged from 43.03 on the 13th of February sowing to 46.59 on the 30th of March sowing of mungbean. It was determined that cultivars had no substantial impact on thousand-grain weight. Sowing dates had a substantial impact on the shelling percentage. The mean shelling percentage was 54.56 and it ranged from 53.41 on the 13th of February sowing to 55.56 on the 15th of March sowing of mungbeans. The effect of cultivars on shelling percentage was found nonsignificant. The cultivars behaved differently for the pod length and seeds per pod; the difference among the cultivars for the pod length and seeds per pod can be described as differences in the genetic makeup [8, 25].

3.4. Grain Yield. Grain yield was significantly affected by both sowing dates and varieties. The mean grain yield of mungbean was 2007 kg ha^{-1} and it ranged from 1799 kg ha^{-1} to 2223 kg ha^{-1}. March 30 plantation resulted significantly in the highest yield due to more pod, the longest pod length, more number of pods per cluster, and the highest 1000 grain weight. Miah et al. (2009) reported a high yield of mungbean obtained on March 2 and the lowest yield reported on April

Table 3: Effect of different sowing dates and selected cultivars on number of leaves, plant height, and above-ground dry matter of spring mungbean at AFU, Rampur, Chitwan, 2019.

Treatments	No of leaves	Plant height (cm) matter (%)	Above ground dry
	75 DAS	75 DAS	75 DAS
Date of planting (*D*)			
D1 = February-13	11.57^{bc}	52.44^{b}	403.00^{c}
D2 = February-28	11.31^{c}	57.57^{a}	425.39^{bc}
D3 = March-15	12.28^{ab}	56.56^{a}	450.73^{b}
D4 = March-30	12.75^{a}	58.92^{a}	505.12^{a}
SEM (±)	0.30	1.60	16.76
LSD (0.05)	0.71*	3.9**	41.01**
CV (%)	3.10	3.50	4.60
Cultivars (*V*)			
*V*1 = Kalyan	11.83^{a}	55.13^{a}	442.21^{a}
*V*2 = Partikshya	12.18^{a}	56.31^{a}	443.80^{a}
*V*3 = Partigya	12.34^{a}	56.46^{a}	447.48^{a}
*V*4 = Pant-5	11.56^{a}	57.61^{a}	450.76^{a}
SEM (±)	0.43	1.28	10.95
LSD (0.05)	Ns	ns	ns
CV (%)	8.90	5.60	6.00
Grand mean	11.98	56.37	446.06

Treatment mean followed by common letters within the same column are not significantly different from each other based on DMRT at a 5% level of significance.

Table 4: Effect of different sowing dates and selected cultivars on yield attributing characteristics of spring mungbean at AFU, Rampur, Chitwan, 2019.

Parameters	Yield attributing characters						
	Plants plot^{-1}	Clusters plant^{-1}	Pods plant^{-1}	Pod length (cm)	Seeds pod^{-1}	1000-Seed wt (g)	Shelling (%)
Date of planting (D)							
D1 = February 13	194^{a}	7.05^{b}	18.72^{c}	8.83^{b}	9.33^{b}	43.03^{b}	53.41^{b}
D2 = February 28	195^{a}	9.34^{a}	18.85^{bc}	8.93^{b}	9.55^{ab}	44.21^{ab}	54.36^{ab}
D3 = March 15	193.5^{a}	9.62^{a}	19.90^{ab}	9.30^{a}	9.81^{a}	45.51^{a}	55.56^{a}
D4 = March 30	194^{a}	9.69^{a}	20.11^{a}	9.16^{ab}	9.97^{a}	46.59^{a}	54.90^{a}
SEM (±)	0.94	0.53	0.46	0.14	0.19	0.97	0.59
LSD (0.05)	ns	1.33**	1.13*	0.33**	0.44*	2.38*	1.44*
CV (%)	0.60	7.30	2.90	1.80	2.30	2.70	1.30
Cultivars (V)							
*V*1 = Kalyan	241666^{a}	8.76	19.01	8.82^{b}	9.36^{b}	43.70	54.96
*V*2 = Partikshya	242291^{a}	8.81	19.20	8.90^{b}	9.48^{b}	45.80	54.59
*V*3 = Partigya	244375^{a}	8.95	19.33	9.54^{a}	10.04^{ab}	44.58	54.65
*V*4 = Pant-5	243125^{a}	9.19	20.04	8.95^{b}	9.77^{a}	45.26	54.03
SEM (±)	1211.80^{a}	0.29	0.50	0.22	0.25	1.06	0.79
LSD (0.05)	ns	ns	Ns	0.46*	0.51*	ns	ns
CV (%)	1.20	7.90	6.30	6.10	6.20	5.80	3.50
Grand mean	242864.58	8.93	19.40	9.06	9.66	44.83	54.56

Treatment mean followed by common letters within the same column are not significantly different from each other based on DMRT at a 5% level of significance.

11 [26], which was according to our findings. The highest seed yield obtained from the 2 March sowing might be due to suitable temperature prevailing accompanied by higher soil moisture content due to sufficient rainfall in April, which enhanced the vegetative as well as reproductive growth of the crop. Pant-5 gave the highest yield due to its genetic potential. The effect of sowing dates on biological yield was nonsignificant but the effect of cultivars on biological yield was significant. The mean biological yield of mungbean was 5830 kg ha^{-1} and it ranged from 5620 kg·ha^{-1} to 6032 kg·ha^{-1} (Table 5). The harvest index was significantly affected by sowing dates. The mean harvest index was 34.36 and it ranged from 31.11 on the 13th of February sowing to 37.17 on the 15th of March sowing of mungbeans [27]. Seijoon et al.

Table 5: Effect of different sowing dates and selected cultivars on grain yield (kg·ha^{-1}), biological yield (kg·ha^{-1}), and harvest index of spring mungbean at AFU, Rampur, Chitwan, 2019.

Treatments	Parameters measured		
	Grain yield (kg·ha^{-1})	Biological yield (kg·ha^{-1})	Harvest Index (%)
Date of planting (*D*)			
D1 = February-13	1799^{b}	5777	31.11^{c}
D2 = February-28	1903^{b}	5687	33.45^{bc}
D3 = March-15	2105^{a}	5895	35.70^{ab}
D4 = March-30	2223^{a}	5962	37.17^{a}
SEm (±)	72.50	121.40	0.62
LSD (0.05)	177.3**	Ns	1.53**
CV (%)	4.40	4.60	2.20
Cultivars (*V*)			
*V*1 = Kalyan	1848^{b}	5620^{c}	32.83^{a}
*V*2 = Partikshya	1983^{ab}	5765^{bc}	34.34^{a}
*V*3 = Partigya	2080^{a}	5903^{ab}	35.20^{a}
*V*4 = Pant-5	2119^{a}	6032^{a}	35.07^{a}
SEM (±)	75.60	106.50	0.95
LSD (0.05)	156.1**	219.8**	ns
CV (%)	9.20	4.50	6.70
Grand mean	2007	5830	34.36

Treatment mean followed by common letters within the same column are not significantly different from each other based on DMRT at a 5% level of significance.

(2000) also found similar results and suggested that the increased harvest index with late sowing could be related to high assimilate use efficiency due to increased sink capacity.

4. Discussion

The environment has a significant impact on the growth and development of crops. In each yield improvement program, breeders select superior genotypes under stress conditions. Planting time is the single most crucial element for maximizing mungbean production. So it is critical to choose the best time to grow mungbean because the expression of genetic potential varies with different environmental interactions.

This study shows that phenological traits like emergence, trifoliate, flowering, physiological pod formation, and harvest maturity have a significant relationship with days of sowing. Varieties do not show any significant relation with physiological and harvest maturity. Biometric traits like plant height and above-ground dry matter have a significant association with the sowing date, with the highest value on March 30. Statistically, biometric traits are not influenced by treated varieties, as shown in Table 3. Yield-attributing characters like clusters per plant and seed per plant have a significant association with planting date but no relation with plant population (Table 4). Grain yield has a significant association with the planting date on March 15–30 with 2.223 tons/ha with Pratigya, Pant-5 cultivars followed by Pratikshya and Kalyan. The harvesting index shows that plantations on March 15–30 had a higher index value of 37.17 for all cultivars. However, it is important to note that this study's findings are limited to Chitwan and may only be useful for similar microclimatic conditions. Therefore, further research is needed to understand the level of interaction to genotype performance through the environment, fertility evaluation of different pipeline genotypes through application of phytohormones using different analyses such as principle component analysis and cluster analysis. Additionally, it is important to consider that salinity-affected regions might have contradictory performances at optimum sowing time. The utilization of molecular concepts such as QTL (Quantitative Traits Loci) markers and the multiplication of the frequency of genes of interest through advanced technologies like CRISPR are essential for expediting the development of climate-resilient and biofortified crop varieties in various environments. This approach has significant potential for enhancing crop yield and quality [28].

5. Conclusion

The results indicate that early and late planting of mungbean cultivars considerably affected grain yield, yield characteristics, and phenology. The optimum yield of mungbean can be achieved through high-yielding varieties planted at a suitable time. Too early sowing in sowing of spring mungbeans in February delay the germination, poor emergence due to a low temperature of soil takes more time to maturity and less yielder; however, planting on March 15–March 30 is suitable for overall growth and production for mungbean due to favorable agroclimatic condition during this period. Cultivar Pant-5 yielded more grain yield which is statistically at par with Partigya and Partikshya might be its superior genetic makeup.

Data Availability

The data supporting this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

Authors' Contributions

M.P. Neupane carried out the fieldwork, performed the statistical analysis, and drafted the manuscript. The rest of the authors coordinated the study, supervised fieldwork, and contributed to the writing of the manuscript. The final manuscript has been read and approved by all authors for submission.

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