

ASSESSMENT OF GREEN POD YIELD AND YIELD-ASSOCIATED TRAITS IN WINGED BEAN GENOTYPES UNDER AMBIKAPUR CONDITIONS DURING *KHARIF* SEASON

Kiran Tigga^{1*}, Saraswati Pandey², Mayuri Sahu³ Gajala Ameen¹, Laxmi Singh¹, Neelam Shekhawat⁴

¹Department of Genetics and Plant Breeding, Zonal Agricultural Research Station, Ambikapur, Chhattisgarh-497001

²Department of Vegetable Science, Zonal Agricultural Research Station, Ambikapur, Chhattisgarh-497001

³Department of Genetics and Plant Breeding, IGKV, Raipur, Chhattisgarh-492012

⁴Department of Genetics and Plant Breeding, ICAR, NBPGR, RS, Jodhpur, Rajasthan

ABSTRACT

Winged bean (*Psophocarpus tetragonolobus* (L.) DC.) is an underutilized multipurpose legume with considerable potential as a vegetable and protein-rich crop. A field investigation was conducted during *Kharif* 2025 at Zonal Agricultural Research Station Ambikapur, Chhattisgarh, to evaluate nine genotypes for green pod yield and associated traits using a randomized block design with three replications. Among the tested entries, genotype RMDWB 23-1 exhibited superior performance, recording the highest green pod yield (171.01 q ha⁻¹), along with 282.17 pods plant⁻¹, 15.08 cm pod length, 16.20 seeds pod⁻¹, and 35.96 q ha⁻¹ seed yield. Correlation analysis revealed significant associations between total green pod yield and key yield components, including first-picking yield ($r = 0.770$), seed weight ($r = 0.667$), seed yield ($r = 0.710$), and pods plant⁻¹ ($r = 0.654$), with the strongest correlation observed for total yield ($r = 0.973$). Based on numerical performance and trait associations, RMDWB-23-1 emerged as the most promising genotype and warrants further evaluation for potential release and wider cultivation.

KEYWORDS: Winged bean, Genotype evaluation, Green pod yield, Correlation analysis, Agro-climatic conditions

1. INTRODUCTION

Winged bean (*Psophocarpus tetragonolobus* (L.) DC.), a tropical legume of the family Fabaceae, is valued for its versatility as both a vegetable and a protein rich seed crop. Nearly all plant parts are edible and nutritionally rich, making it a potential contributor to food and nutritional security. Despite these advantages, winged bean remains underutilized compared to other legumes such as soybean and chickpea, largely due to limited varietal improvement and lack of systematic evaluation [1,2].

Green pod yield in winged bean is a complex quantitative trait influenced by multiple factors, including pod number, pod size, seeds per pod, successive picking performance and seed yield. Understanding the contribution of these components is critical for guiding breeding strategies and enhancing productivity. Previous studies have reported significant genetic variability and trait associations in winged bean. Diallel analyses highlighted variation in yield components [1], while correlation studies emphasized pod number and seed weight as key determinants of productivity [2]. More recent evaluations in Kerala and West Bengal confirmed promising genotypes under local conditions [3,6], and yield stability analyses underscored the importance of multilocation trials [4]. Agronomic investigations have also demonstrated the role of biofertilizers in enhancing growth and yield [5].

In light of these findings, the present study was conducted during *Kharif* 2025 at Zonal Agricultural Research Station, Ambikapur, Chhattisgarh. Nine genotypes were evaluated using a Randomized Block Design with three replications to assess their performance for green pod yield and associated traits. The objective was to identify promising entries with superior productivity and adaptability, thereby contributing to the expansion of winged bean cultivation and its potential inclusion in mainstream legume improvement programs.

2. MATERIALS AND METHODS

Experimental Site and Design

The experiment was conducted during *Kharif* 2025 at Zonal Agricultural Research Station farm, Ambikapur, Chhattisgarh, India. The study site was located at 20.08°N latitude, 83.015°E longitude and an altitude of 592.62 m above mean sea level. Nine-winged bean genotypes were evaluated using a Randomized Block Design (RBD) with three replications. Each plot measured 3 m × 6 m, comprising 10 rows. Plant spacing was maintained at 60 cm × 30 cm, and fertilizer was applied at 20:40:20 N:P:K:S kg ha⁻¹. The materials were taken from All India Coordinated Research Network on Potential crops.

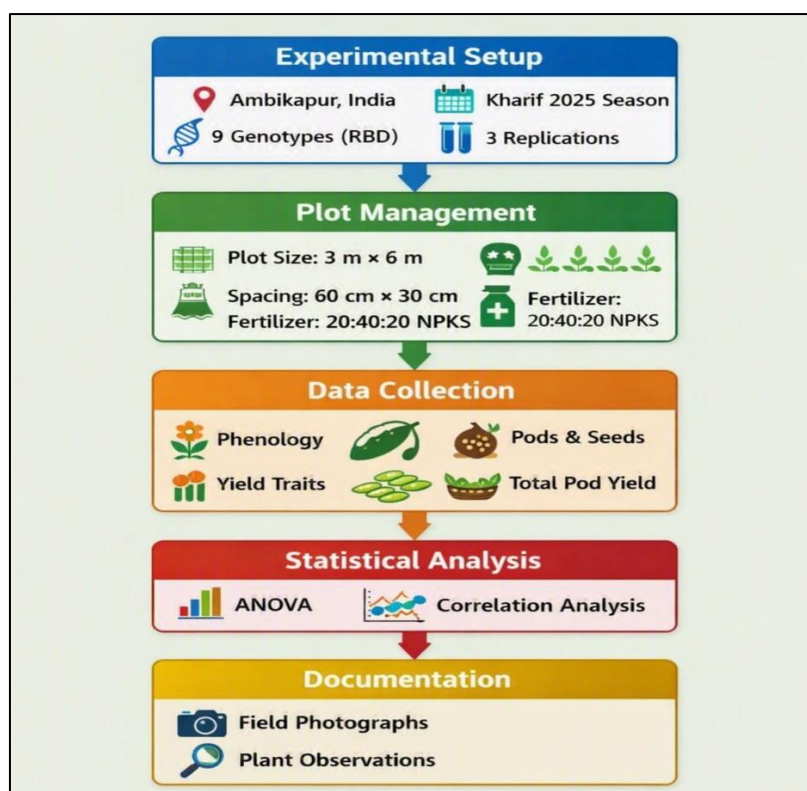


Figure 1: The experimental work flow of winged bean genotypes

The experimental work flow for evaluating winged bean genotypes followed a systematic sequence of experimental setup, plot management, data collection and statistical analysis is illustrated in Figure 1 and field photographs of the winged bean varietal trial at ZARS, Ambikapur during *kharif* season was shown in Figure 2.

Data Collection and Statistical Analysis

Observations were systematically recorded on a set of phenological, yield component, and yield traits to evaluate the performance of winged bean genotypes under field conditions. Phenological traits included days to 50% flowering, pod setting and physiological maturity, which provided insights into the growth duration and reproductive behaviours of the entries. Yield components were assessed in terms of pod length, number of pods per plant, seeds per pod, 100-seed weight and plant stand, as these parameters collectively determine the productivity potential of the crop. In addition, yield traits were measured through green pod yield at successive pickings, total green pod yield and seed yield, thereby capturing both vegetative and reproductive contributions to overall performance.

Genotypic means were calculated for each trait to facilitate comparison among the entries. The variability in performance was examined to identify promising genotypes with desirable combinations of traits. To understand the interrelationships among yield components, correlation analysis was performed. This statistical approach enabled the identification of traits that were positively or negatively associated with yield, thereby highlighting potential selection criteria for breeding programs.

Furthermore, analysis of variance (ANOVA) was conducted for total green pod yield using replication data. This allowed for the partitioning of observed variation into genotypic and error components, providing a measure of statistical significance for differences among genotypes. The ANOVA results were interpreted to determine whether observed numerical differences in yield were statistically meaningful or simply due to random variation.

3. RESULTS AND DISCUSSION

3.1 Green pod yield performance

Significant numerical variation was observed among the nine-winged bean genotypes for green pod yield at ZARS, Ambikapur conditions during *Kharif* 2025. Genotype RMDWB 23-1 recorded the highest yield (171.01 q ha⁻¹), followed by Chhattisgarh Chaudhari Sem-2 (134.50 q ha⁻¹), Indira Winged bean-2 (116.94 q ha⁻¹) and MZWB 22-1 (116.02 q ha⁻¹). The lowest yield was obtained from RWB-40 (104.56 q ha⁻¹). Figure 1 provides a clear graphical representation of the variation in green pod yield performance among the evaluated genotypes.

Analysis of variance indicated an F-value of 0.34 for genotype effect, which was below the 5 % F-critical value (df=8, 16). Hence, the observed differences were not statistically significant and the superior performance of RMDWB 23-1 should be interpreted as promising rather than significant. Further multilocation and multi-season trials are required to validate its yield stability.

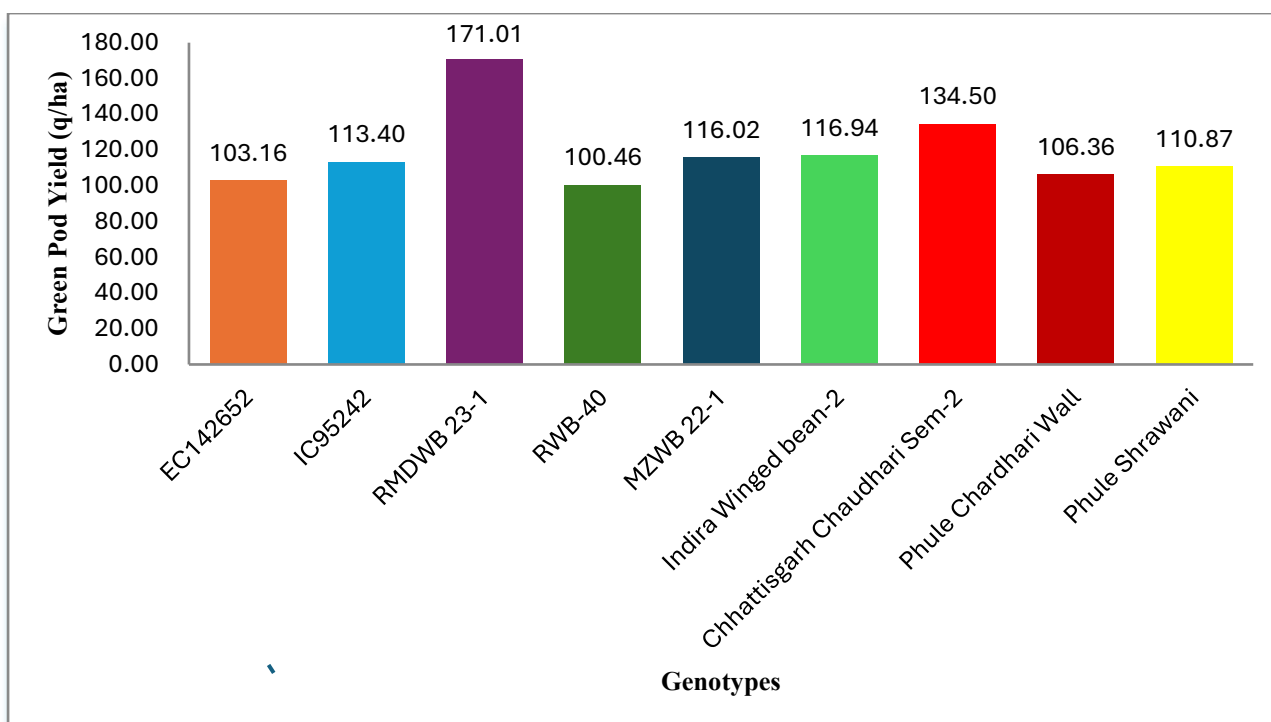


Figure 2: Green pod yield of nine-winged bean genotypes at ZARS, Ambikapur conditions during *Kharif* 2025.

Table 1. Performance of nine-winged bean genotypes for major yield traits

Genotype	Green pod yield (q ha ⁻¹)	Pods plant ⁻¹	Pod (cm)	length	Seeds pod ⁻¹	Seed (q ha ⁻¹)	yield
EC142652	103.15	167.90	15.83		10.07	21.37	
IC95242	113.40	248.47	14.25		13.13	13.76	
RMDWB 23-1	171.01	282.17	15.08		16.20	35.96	
RWB-40	104.56	211.33	11.64		11.80	10.40	
MZWB 22-1	116.02	232.60	14.47		8.80	33.09	
Indira Winged bean-2	116.94	214.27	14.66		13.07	22.48	
Chhattisgarh Chaudhari Sem-2	134.50	229.93	16.93		12.33	31.57	
Phule Chardhari Wall	106.36	258.13	16.25		13.87	23.84	
Phule Shrawani	110.87	216.80	18.36		12.07	12.07	

3.2 Yield-Associated Traits

Among the evaluated genotypes, RMDWB 23-1 exhibited the highest number of pods per plant (282.17), coupled with a pod length of 15.08 cm and 16.20 seeds per pod. It also achieved a seed yield of 35.96 q ha⁻¹, reflecting a favourable integration of pod-bearing capacity, pod size, and seed productivity. In comparison, Chhattisgarh Chaudhari Sem-2 produced fewer pods per plant (229.93) but exhibited longer pods (16.93 cm) and a seed yield of 31.57 q ha⁻¹, while Indira Winged Bean-2 recorded 214.27 pods per plant with moderate pod length (14.66 cm) and a seed yield of 22.48 q ha⁻¹. Other entries, such as MZWB 22-1 and Phule Chardhari Wall, showed competitive seed yields (33.09 and 23.84 q ha⁻¹, respectively). In comparison with others entries, RMDWB 23-1 combined high pod-bearing ability with balanced pod morphology and seed productivity, thereby offering a distinct yield advantage over the other genotypes.

3.3 Association of Yield with Component Traits

Correlation analysis revealed a strong positive association between total green pod yield and second-picking yield ($r=0.973$). Positive correlations were also observed with first-picking yield ($r=0.773$), 100-seed weight ($r=0.767$), seed yield ($r=0.710$), and pods per plant ($r=0.654$). These relationships suggest that sustained

productivity across successive pickings and enhanced pod-bearing ability are key determinants of yield potential. However, correlation indicates association and further regression analysis also for help in clarify the contribution of individual traits.

Table 2. Correlation of green pod yield with selected traits

Trait	Correlation coefficient (r)
Second picking yield	0.973
First picking yield	0.773
100-seed weight	0.767
Seed yield	0.710
Pods plant ⁻¹	0.654

3.4 Identification of the most promising genotype

The scatter plot shows a clear positive trend ($r = 0.654$) between pods per plant and total green pod yield of winged bean genotype under ZARS Ambikapur conditions is shown in figure 3.

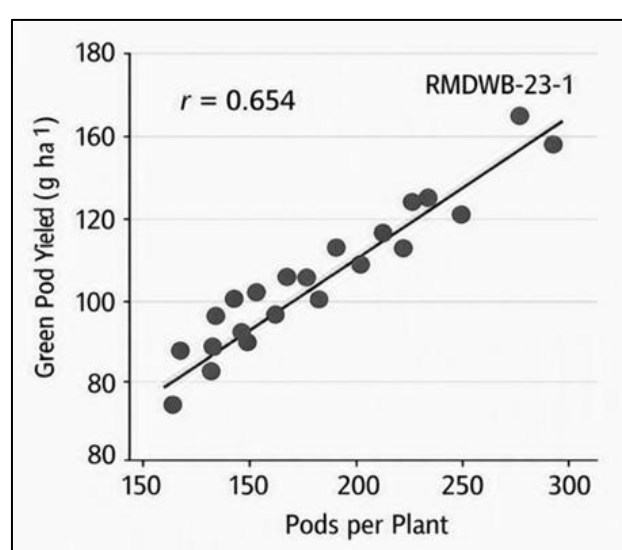


Figure 3: Relationship between pods per plant and total green pod yield of winged bean genotypes

It indicates that genotypes with higher pod bearing capacity tend to produce greater green pod yield. RMDWB 23-1 appears at the upper right of the graph, confirming its superior performance both in pod number (282.17 pods plant⁻¹) and yield (171.01 q ha⁻¹).

Based on the integrated assessment of yield and associated traits, genotype RMDWB 23-1 emerged as the most promising genotype. The qualitative summary of trait contribution to yield potential was shown in table 3. It consistently combined superior green pod yield with enhanced pod-bearing capacity, favourable pod length, higher seed number per pod and seed yield. This balanced expression of both phenological and yield-related attributes underscores its potential as a high-performing genotype. In view of these results, RMDWB 23-1 genotype provides advancement to multilocation and multi-season trials to evaluate its adaptability, yield stability and broader agronomic suitability prior to any varietal recommendation.

Table 3: Trait contribution to yield potential (qualitative summary)

Trait	Contribution to yield	Key genotype(s) showing advantage
Pods per plant	Strong positive	RMDWB 23-1 (282.17)
Pod length	Moderate positive	Phule Shrawani (18.36 cm)
Seeds per pod	Moderate positive	RMDWB 23-1 (16.20)
Seed yield	Strong positive	RMDWB 23-1 (35.96 q ha ⁻¹)
Successive pickings	Very strong positive	RMDWB 23-1, Chhattisgarh Chaudhari Sem-2

5. CONCLUSION

The present evaluation revealed substantial variability among nine-winged bean genotypes under Ambikapur conditions during *Kharif*2025. Among these, genotype RMDWB 23-1 recording the highest green pod yield

(171.01 q ha⁻¹) and exhibiting a favorable combination of yield associated traits, including superior pod-bearing capacity, desirable pod length, and elevated seed yield.

Strong positive correlations of green pod yield with successive picking yields, 100-seed weight, seed yield, and pods per plant highlight these traits as valuable selection criteria for yield improvement. Based on its superior performance, RMDWB 23-1 is recommended for further multilocation, multi-season, and stability trials to confirm its adaptability, potential and agronomical suitability.

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A) Plant Stand at Field



B) Green Pods of Winged Bean