

## Original Research Article

### Response of Intercropping Finger millet on Growth and Yield of Pulses

#### ABSTRACT

A field experiment was conducted during *kharif* season in Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P.). The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.6), low in organic carbon (0.51 %), available N (78.9 kg/ha), available P (32.88 kg/ha) and available K (385.10 kg/ha). The treatments consisted of 3 pulse crops (Cowpea, Black gram and green gram) and 3 row ratios (2:1, 4:1 and 6:1). The experiment was laid out in a Randomized Block Design with 13 treatments and replicated thrice. Maximum plant height and yield attributes was recorded in sole plots of cowpea (treatment 11), Black gram (treatment 12) and Green gram (treatment 13) respectively. Finger millet equivalent yield was recorded high in (treatment 7) where finger millet was intercropped with green gram in 2:1 ratio.

**Key words:** *Black gram, Cowpea, Finger millet, Finger millet equivalent yield, Green gram, growth, intercropping, yield attributes.*

#### INTRODUCTION

Pulses are widely recognized as key sources of plant-based protein, particularly for those following a vegetarian diet. They contribute significantly to soil health due to their nitrogen-fixing capabilities, enhancing soil fertility. According to **Tiwari and Shivhare (2016)**, pulses can fix between 72 to 350 kg of nitrogen per hectare annually. This ability positions pulses as crucial components of sustainable farming practices. Additionally, the structural and functional characteristics of pulses allow them to thrive in rainfed environments with limited water supply, making them versatile for various agricultural systems including intercropping, mixed cropping, and crop rotations.

The use of fallow lands is a strategic approach to augmenting pulse production, particularly during the summer when water scarcity limits irrigation options. Millets, known for their

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drought resilience, are an excellent choice for such conditions. Finger millet, scientifically known as *Eleusine coracana* (L.) Gaertn., stands out for its remarkable water efficiency, requiring only 28% of the water needed for paddy cultivation, as reported by **Rurinda et al. in 2014**. This characteristic makes finger millet an ideal crop for areas with limited water availability, contributing to sustainable agricultural practices.

Intercropping is a strategic agricultural practice that maximizes resource use efficiency in both space and time. **Kumar and Ray's 2020** study found that finger millet cultivated alone yielded the highest productivity. However, when it comes to intercropping systems, the combination of finger millet and black gram led to the highest yield of finger millet. Nonetheless, the success of intercropping hinges on the compatibility and synergistic relationship between the different plant species involved. To further boost crop yields and maintain soil health, integrating biofertilization with intercropping has been suggested as a sustainable approach, as per **Wezel et al. 2014**. **Li et al. 2014**, also highlighted that specific root-microbe interactions can influence nutrient mobilization, leading to more effective nutrient uptake. The current research aims to evaluate the growth and yield of various pulses namely cowpea (*Vigna unguiculata* L.), black gram (*Vigna mungo* L.) and green gram (*Vigna radiata* L.) and when cultivated as intercrops with finger millet.

## MATERIALS AND METHODS

The experiment was conducted to know the Response of Intercropping with Finger millet on Growth and Yield of Pulses at Crop Research Farm of Sam Higginbottom University, Prayagraj, Uttar Pradesh where finger millet variety *VL Mandua 376*, was intercropped with pulses, viz., cowpea (*Kashinidhi*), black gram (*Cac 3315*) green gram (*SML 668*), and in the ratio of 2:1, 4:1 and 6:1. The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.6), low in organic carbon (0.51 %), available N (178.9 kg/ha), available P (32.88 kg/ha) and available K (385.10 kg/ha). The experiment was laid out in Randomized Block Design with thirteen treatments including control each replicated thrice. The treatments consisted of 3 pulse crops (Cowpea, Black gram and green gram) and 3 row ratios (2:1, 4:1 and 6:1). Biostatics observation on plant height (cm) were recorded from five sample plants from each treatment at 15, 30, 45 and 60 DAS. The data also included records of yield and its associated characteristics. The overall production potential of intercropping pulses in finger millet was assessed in terms of finger millet equivalent yield (FMEY). Finger millet equivalent yield (kg/ha) was computed based on the seed yield (kg/ha) of the

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intercropped pulses and prevailing market price (INR kg/ha) of finger millet and pulses, based on the crop equivalent yield concept suggested by **Lal and Ray (1976)** and **Verma and Modgal (1983)**.

## RESULTS AND DISCUSSION

### GROWTH PARAMETER

At 60 days after sowing (DAS), cowpea plants in the sole cowpea plot (treatment 11) exhibited a significant increase in height, reaching an average of 55.18 cm. In contrast, the height of cowpea plants grown in a 2:1 intercropping ratio with finger millet (treatment 1) was found to be statistically similar. For black gram grown alone (treatment 12), a notable height of 28.82 cm was recorded at 60 DAS. Among the intercropping treatments, black gram achieved greater heights when grown in a 2:1 ratio with finger millet (treatment 4). Similarly, green gram plants cultivated without intercropping (treatment 13) were significantly taller, measuring 37.05 cm at 60 DAS, and this height was observed to be on par with green gram plants intercropped with finger millet in a 2:1 ratio (treatment 7).

### YIELD PARAMETERS

In the study of crop yields, the sole crop plots of cowpea, black gram, and green gram, corresponding to treatments 11, 12, and 13 respectively, were observed to have a significantly higher number of pods per plant and seeds per pod. **De Oliveira et al. (2017)** Grain yield of cowpea was observed to be significantly higher under sole cropping than under intercropping with millets and it was attributed to the greater plant stand since variation could not be observed in the number of pods per plant, number of grains per pod and thousand grain weight. When exploring the effects of intercropping with finger millet, it was found that cowpea, when paired in a 2:1 ratio (treatment 1), maintained a high number of pods and seeds per pod. A similar trend was observed in black gram and green gram when intercropped with finger millet in the same ratio (treatments 4 and 7, respectively), with both crops achieving a high pod count and

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seeds per pod. The test weight remained consistent across all treatments, indicating no significant impact from the different cropping methods.

In terms of yield, the sole cropping of cowpea, black gram, and green gram resulted in a significantly higher seed and stover yield. Among the intercropping treatments, the combination of finger millet with cowpea, black gram, and green gram in a 2:1 ratio (treatment 1, treatment 4 and treatment 7 respectively) led to the highest yields for each crop. Specifically, cowpea recorded a seed yield of 1005.95 kg/ha and a stover yield of 1792.38 kg/ha, black gram had a seed yield of 1202.96 kg/ha and a stover yield of 1674.68 kg/ha, and green gram achieved a seed yield of 1468.51 kg/ha and a stover yield of 1715.37 kg/ha when intercropped with finger millet. These findings underscore the potential benefits of both sole and specific intercropping. The results of higher yields of sole crops compared to intercropping were in agreement with those of **Ndakidemi and Dakora (2007)**. The yield advantage of sole crops could be due to higher plant density and also due to absence of competition with the main crop of finger millet ratios in optimizing crop production.

#### **Finger millet Equivalent Yield (FMEY) (kg/ha)**

In the comparative study of pulse crops, the intercropping of finger millet with green gram in a 2:1 ratio (treatment 7) emerged as the most productive, yielding the highest Finger Millet Equivalent Yield (FMEY) at 4523.49 kg/ha. This yield was closely matched by the yield from a 4:1 intercropping ratio of finger millet with green gram (treatment 8), which was statistically comparable. Despite the higher market prices of cowpea and black gram, the superior FMEY achieved with green gram can be attributed to the more efficient yield realized in the finger millet and green gram intercropping system, suggesting a better utilization of available resources. The findings indicate that intercropping, particularly with green gram, enhances overall productivity when compared to the sole cropping of finger millet. This underscores the potential economic and agricultural benefits of intercropping strategies over traditional sole cropping methods.

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**Table 1. Effect of intercropping on plant height (cm) of Pulses**

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Treatment No.	Treatment combination	Plant height (cm) 60 DAS		
		Cowpea	Black gram	Green gram
1	Finger millet + Cowpea (2:1 ratio)	54.01	-	-
2	Finger millet + Cowpea (4:1 ratio)	52.67	-	-
3	Finger millet + Cowpea (6:1 ratio)	51.71	-	-
4	Finger millet + Black gram (2:1 ratio)	-	27.64	-
5	Finger millet + Black gram (4:1 ratio)	-	27.02	-
6	Finger millet + Black gram (6:1 ratio)	-	27.97	-
7	Finger millet + Green gram (2:1 ratio)	-	-	36.38
8	Finger millet + Green gram (4:1 ratio)	-	-	35.49
9	Finger millet + Green gram (6:1 ratio)	-	-	34.82
10	Finger millet (sole)	-	-	-
11	Cowpea (sole)	55.18	-	-
12	Black gram (sole)	-	28.82	-
13	Green gram (sole)	-	-	37.05
	SEm(±)	0.280	0.238	0.197
	CD (p=0.05)	0.970	0.825	0.683

**Table 2. Effect of intercropping on yield and yield attributes of Cowpea**

<b>Treatment No.</b>	<b>Treatment combination</b>	<b>Number of Pods/plant</b>	<b>Number of Seeds/pod</b>	<b>Test weight (g)</b>	<b>Seed yield (kg/ha)</b>	<b>Stover yield (kg/ha)</b>
1	Finger millet + Cowpea (2:1 ratio)	14.13	9.06	14.66	1005.95	1792.38
2	Finger millet + Cowpea (4:1 ratio)	13.40	8.86	14.23	957.04	1778.08
3	Finger millet + Cowpea (6:1 ratio)	13.06	8.46	14.62	927.50	1662.50
11	Cowpea (sole)	14.20	9.13	14.75	1343.61	1955.91
	SEm(±)	0.144	0.094	0.249	12.203	23.103
	CD (p=0.05)	0.498	0.326	-	42.228	79.947

**Table 3. Effect of intercropping on yield and yield attributes of Black gram.**

<b>Treatment No.</b>	<b>Treatment combination</b>	<b>Number of Pods/plant</b>	<b>Number of Seeds/pod</b>	<b>Test weight (g)</b>	<b>Seed yield (kg/ha)</b>	<b>Stover yield (kg/ha)</b>
4	Finger millet + Black gram (2:1 ratio)	23.0	7.93	28.92	1202.96	1674.68
5	Finger millet + Black gram (4:1 ratio)	22.60	7.73	29.18	1161.59	1620.22
6	Finger millet + Black gram (6:1 ratio)	21.26	7.33	29.18	952.96	1563.43
12	Black gram (sole)	24.06	8.60	30.78	1419.08	1722.20
	SEm(±)	0.224	0.066	0.420	36.768	25.802
	CD (p=0.05)	0.776	0.230	-	127.236	89.290

**Table 4. Effect of intercropping on yield and yield attributes of Green gram.**

Treatment No.	Treatment combination	Number of Pods/plant	Number of Seeds/pod	Test weight (g)	Seed yield (kg/ha)	Stover yield (kg/ha)
7	Finger millet + Green gram (2:1 ratio)	27.46	8.26	33.87	1468.51	1715.37
8	Finger millet + Green gram (4:1 ratio)	26.93	7.73	34.27	1391.10	1694.12
9	Finger millet + Green gram (6:1 ratio)	26.06	7.53	34.21	1258.32	1495.77
13	Green gram (sole)	28.60	8.73	34.35	1691.84	1954.76
	SEm(±)	0.227	0.149	0.629	33.680	37.352
	CD (p=0.05)	0.787	0.515	-	116.550	129.257

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 1725.37 --> 1730  
 33.87 --> 33.9  
 33.680 --> 33.7

**Table 5. Effect of intercropping Finger millet with pulses on Finger millet Equivalent Yield (FMEY)**

S. No.	Treatment combination	Finger millet Equivalent yield (FMEY) (Kg/ha)
1.	Finger millet + Cowpea (2:1 ratio)	3729.59
2.	Finger millet + Cowpea (4:1 ratio)	3691.77
3.	Finger millet + Cowpea (6:1 ratio)	3892.19
4.	Finger millet + Black gram (2:1 ratio)	3425.07
5.	Finger millet + Black gram (4:1 ratio)	3465.80
6.	Finger millet + Black gram (6:1 ratio)	3260.30
7.	Finger millet + Green gram (2:1 ratio)	4523.49
8.	Finger millet + Green gram (4:1 ratio)	4484.08
9.	Finger millet + Green gram (6:1 ratio)	4347.56
10.	Finger millet (sole)	-
11.	Cowpea (sole)	-
12.	Black gram (sole)	-
13.	Green gram (sole)	-
	SEm(±)	76.256
	CD (p=0.05)	228.616

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## Conclusion

It can be concluded that incorporating green gram into a finger millet crop at a 4:1 ratio (treatment 8) is an effective strategy to boost the system's overall productivity.

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