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# Performance of sorghum under sorghum legume intercropping system

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**Abstract**
The experiment was carried out during *kharif*, 2019-20 at All India Co-ordinated Research Project on Sorghum, Chamarajanagar District, Karnataka, to study the performance of sorghum under sorghum legume intercropping system. The experiment consists of fourteen treatment combination with different legumes *viz.*, Redgram, Greengram, Blackgram, Cowpea and Field bean in different row proportion of 2:1, 4:1 and 4:2, laidout in Randomized Block Design and replicated thrice. Results of the experiment revealed that treatment combination of sorghum + blackgram (4:2) recorded taller plants (295cm), Increase in leaf area (4760.59cm$^2$), Stem diameter (15.24mm), Earhead length (13.83cm), Ear head width (5.50cm), Earhead weight (61.50g), Sorghum yield (1593kg/ha) and dry fodder yield (13.51t/ha). Combination of sorghum+ blackgram (4:2) is found better under different sorghum+ legume intercropping systems.

**Keywords:** Legume, blackgram, Earhead length, leaf area, yield

## Introduction
Cereal- legumes intercropping culture is widely practiced in tropical and subtropical regions of the world by small farmers. Following this system of cropping aimed to avoid dependence on a mono crop, obtain a variety of products from the same piece of land, improve efficiency of the available resources (labour etc.) and farm income from small holdings. Cultivation of two or more crops simultaneously in the same field for higher yield and economic returns. Sorghum is mainly cultivated in the tropical and subtropical climates, especially in the semiarid tropics. After rice, wheat, maize and barley it is fifth most important cereal crop. It is an important staple food crop of Karnataka. Productivity of Sorghum is declining in the recent years, due to it is mainly grown as rainfed crop, no proper nutrient management was taken, deterioration in soil fertility, increasing trends towards continuous cultivation of the cereal mono crop in place of traditional rotation and intercropping system.

Cereal legume intercropping is the better option that induce productivity of crops. Intercropping system increases productivity than sole cereal systems in semi-arid area. Increase in the yield of sorghum due to complimentary effect of legumes that is biological nitrogen fixation (BNF) helps in reducing the amount N fertilizer. Appropriate fertilization with respect to type, amount, time and method of fertilizer application can increase the advantage of intercropping (Undie *et al.*, 2012) [9]. Due to the rising cost of chemical fertilizers, crop nutrient uptake and utilization must be most efficient to reduce cost of production and achieving higher profit. Hence, intercropping legumes with cereals is particularly important in countries where the cost of N fertilizer is and/or availability of fertilizer is limited. By keeping the above reason research was designed to study the performance of sorghum under different legumes with different row ratios.

## Material and Methods
A field experiment was conducted during *Kharif*, 2019-20 to study the performance of sorghum under sorghum legume intercropping system at AICRP on Sorghum, KVK, Hardanahalli, Chamarajanagar district, University of Agricultural Sciences, Bengaluru. The experiment was laid out with Randomized Block design and replicated thrice. The total treatment combination were fourteen with different legume *viz.*, pigeonpea, blackgram, greengram, cowpea and field bean were sown at spacing 37.5cm×15cm. The plot size was 3m×4.8 m. Recommended dose of fertilizer as 65:40:40 kg NPK per hectare. Other recommended practices like thinning, weeding, application of pesticide were uniformly followed. Crop was harvested at maturity stage, seed yield per net plot of each treatment was recorded. The various biometric observations, analytical data of plant sample and the

computed data were subjected to statistical scrutiny as per the procedures given by Gomez and Gomez, 1984 [5]. The treatment differences were worked out at five per cent probability level.

## Results and Discussion

### Growth parameters

Treatment combination of Sorghum+Blackgram(4:2) recorded the highest plant height (295cm), Increased in leaf area (4760.59cm$^2$) and stem diameter (15.24mm) in table 1. Increase in growth parameters due to the increase in nitrogen content of sorghum by nitrogen fixation by legume crops. Enhances the photosynthesis and metabolic activities of plants, which reflected on the increase in vegetative growth of sorghum. Similar finding where reported by Berhane *et al*., 2015 [3].

**Table 1:** Effect of intercropping of legume in sorghum on Plant height (cm), Leaf area (cm$^2$) and Stem diameter (mm)

| Treatment details | Plant height (cm) | leaf area (cm$^2$) | Stem diameter (mm) |
|---|---|---|---|
| $T_1$ - Sorghum+Redgram(2:1) | 203.00 | 2569.68 | 12.01 |
| $T_2$ - Sorghum+Greengram(2:1) | 264.00 | 3740.13 | 13.63 |
| $T_3$ - Sorghum+Blackgram(2:1) | 268.00 | 3881.97 | 13.94 |
| $T_4$ - Sorghum+Cowpea(2:1) | 211.00 | 2825.45 | 12.11 |
| $T_5$ - Sorghum+Field bean(2:1) | 215.00 | 2953.75 | 12.56 |
| $T_6$ - Sorghum+Greengram(4:1) | 206.00 | 2902.06 | 12.09 |
| $T_7$ - Sorghum+Blackgram(4:1) | 226.00 | 3163.80 | 12.78 |
| $T_8$ - Sorghum+Cowpea(4:1) | 197.00 | 2342.44 | 11.64 |
| $T_9$ - Sorghum+Field bean(4:1) | 200.00 | 2460.10 | 11.92 |
| $T_{10}$ - Sorghum+Greengram(4:2) | 284.00 | 4528.79 | 14.83 |
| $T_{11}$ - Sorghum+Blackgram(4:2) | 295.00 | 4760.59 | 15.24 |
| $T_{12}$ - Sorghum+Cowpea(4:2) | 238.00 | 3332.87 | 12.92 |
| $T_{13}$ -Sorghum+Field bean(4:2) | 251.00 | 3478.38 | 13.01 |
| $T_{14}$ -Sole Sorghum | 273.00 | 4113.13 | 14.00 |
| SEm± | 10.38 | 148.82 | 0.57 |
| CD @5% | 30.17 | 432.61 | 1.67 |

**Table 2:** Performance of sorghum legume intercropping system on sorghum yield attributes

| Treatment details | Ear head length (cm) | Ear head width (cm) | Ear head weight (g) |
|---|---|---|---|
| $T_1$ - Sorghum+Redgram(2:1) | 10.83 | 4.23 | 46.77 |
| $T_2$ -Sorghum+Greengram(2:1) | 13.00 | 4.90 | 56.20 |
| $T_3$ -Sorghum+Blackgram(2:1) | 13.10 | 4.97 | 58.63 |
| $T_4$ -Sorghum+Cowpea(2:1) | 11.47 | 4.40 | 51.97 |
| $T_5$ -Sorghum+Field bean(2:1) | 11.57 | 4.53 | 53.87 |
| $T_6$ -Sorghum+Greengram(4:1) | 10.93 | 4.28 | 49.20 |
| $T_7$ -Sorghum+Blackgram(4:1) | 12.10 | 4.63 | 53.93 |
| $T_8$ -Sorghum+Cowpea(4:1) | 10.23 | 4.08 | 43.23 |
| $T_9$ -Sorghum+Field bean(4:1) | 10.53 | 4.13 | 45.30 |
| $T_{10}$ -Sorghum+Greengram(4:2) | 13.70 | 5.17 | 60.97 |
| $T_{11}$ -Sorghum+Blackgram(4:2) | 13.83 | 5.50 | 61.50 |
| $T_{12}$ -Sorghum+Cowpea(4:2) | 12.30 | 4.67 | 54.60 |
| $T_{13}$ -Sorghum+Field bean(4:2) | 12.87 | 4.80 | 54.83 |
| $T_{14}$ -Sole Sorghum | 13.13 | 5.00 | 59.63 |
| SEm± | 0.53 | 0.20 | 2.35 |
| CD @5% | 1.55 | 0.59 | 6.84 |

**Table 3:** Response of intercropping of legume in sorghum on the Sorghum yield (kg/ha) and Dry fodder yield(t/ha)

| Treatment details | Sorghum yield (kg/ha) | Dry fodder yield (t/ha) |
|---|---|---|
| $T_1$ - Sorghum+Redgram(2:1) | 1263 | 7.55 |
| $T_2$ -Sorghum+Greengram(2:1) | 1426 | 12.76 |
| $T_3$ -Sorghum+Blackgram(2:1) | 1448 | 12.85 |
| $T_4$ -Sorghum+Cowpea(2:1) | 1323 | 8.05 |
| $T_5$ -Sorghum+Field bean(2:1) | 1349 | 8.76 |
| $T_6$ -Sorghum+Greengram(4:1) | 1308 | 7.76 |
| $T_7$ -Sorghum+Blackgram(4:1) | 1393 | 9.14 |
| $T_8$ -Sorghum+Cowpea(4:1) | 1085 | 7.06 |
| $T_9$ -Sorghum+Field bean(4:1) | 1159 | 7.26 |
| $T_{10}$ -Sorghum+Greengram(4:2) | 1545 | 13.40 |
| $T_{11}$ -Sorghum+Blackgram(4:2) | 1593 | 13.51 |
| $T_{12}$ -Sorghum+Cowpea(4:2) | 1402 | 9.35 |
| $T_{13}$ -Sorghum+Field bean(4:2) | 1410 | 10.05 |
| $T_{14}$ -Sole Sorghum | 1452 | 13.20 |
| SEm± | 60 | 0.45 |
| CD @5% | 174 | 1.32 |

**Yield Components**

Increased in Earhead length (13.83cm), Ear head width (5.50cm) and Ear head weight (61.50g) in table 2 were recorded with treatment combination of Sorghum+Blackgram (4:2). Due to the short duration, short stature of blackgram and least competition for the available resources like nutrient, water and solar radiation compare to the cowpea and field bean. This results are confirmatory with the finding of Hegde (1983).

**Grain yield and Stover yield**

Sorghum+ Blackgram(4:2) treatment combination recorded the highest yield of 1593kg/ha and stover yield (13.5t/ha) (table 3) compare to the other treatment combination. Higher yield of sorghum when grown with the blackgram due to the complementary effect between base crop and intercrop. Blackgram is a short statured crop, early maturing crop and offered lesser competition for the available resource like solar radiation, water and nutrient compare to the crop like cowpea and field bean. Cowpea and field bean offered the greater competition for the essential resources causes the reduction in yield of sorghum. Similar findings were reported by Amedie *et al*. 2010 [1] and Ananthi *et al*. 2017 [2].

Increase in the stover yield of sorghum due to the trigger growth of ground part of the sorghum due high nitrogen fixation by blackgram which enable the sorghum to effectively utilize the solar radiation which resulted in the corresponding increment of photosynthetic rate. Increase in the photosynthetic rate increases the accumulation of drymatter. Similar results are observed with the finding of Jat *et al*. 2014 [7] and Om Singh and Verma (2018) [8].

**Conclusions**

Form the finding it was concluded that growing of sorghum with blackgram with row ratio of 4:2 increases the growth and yield of sorghum.

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