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Evaluation of Sorghum Based Intercropping System for Yield Maximization in Sorghum

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ABSTRACT

The experiment was conducted during kharif season of 2019 at All India Co-ordinated Research Project on Sorghum, Krishi Vigyan Kendra, Chamarajanagar District, Karnataka. To evaluate the sorghum based legume intercropping system. The experiment consists of fourteen treatment combination with different legumes viz.,Redgram, Greengram, Blackgram, Cowpea and Field bean in different row ratio of 2:1, 4:1 and 4:2. It was laidout in Randomized Complete Block Design and replicated thrice. The results revealed that there was significant increase in sorghum grain yield (1593 kg/ha), Land equivalent ratio (1.35) and Area Time Equivalent ratio(1.32) with sorghum+blackgram(4:2). While higher gross returns (Rs. 44,213 ha), net returns(Rs. 27,434 ha) and Benefit: Cost ratio (2.64) was found with sorghum + green gram(4:2). Increase in Sorghum Equivalent Yield (2,544 kg/ha) was recorded with sorghum+redgram(2:1). From the results it was confirmed that sorghum+ blackgram or sorghum+green gram in 4: 2 row proportion was better in terms of yield and economics compared to the other treatments.

Keywords: *Legume, Blackgram, Yield, LER, B:C ratio and SEY*

INTRODUCTION

Sorghum is mainly cultivated in the tropical and subtropical climates, especially in semi arid climatic condition. In India sorghum is mainly cultivated as rainfed crop in the states of Karnataka, Maharashtra, Andhra Pradesh and Tamil Nadu. In recent year's sorghum area and productivity is declining due to several reasons *viz*., deterioration in soil fertility, shortening of the length of fallow and increasing trends towards continuous cultivation of the high value cereal mono crop in place of traditional rotation and intercropping system.

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Cereal legume intercropping is the better option in the semi arid areas to enhance the productivity of crops. Due to the increasing in cost of chemical fertilizers and weed management. Intercropping of legume with cereals helps in reducing the cost of production for achieving higher profit. Raise in the yield of sorghum due to complimentary effect of legumes associated with the sorghum by means of biological nitrogen fixation (BNF) helps in reducing use of the external N fertilizer application. Legume being short duration crop helps in appropriate fertilization with respect to type, amount and time can increase the advantage of intercropping (Undie et al., 2012) and reducing the weed density in between the base crop. Hence, intercropping legumes with millets is particularly important in dry land crop like sorghum to increase the productivity and economics. By considering the above reasons the research was designed to evaluate the sorghum based legume intercropping system for maximizing the sorghum productivity as well as to get higher returns.

MATERIALS AND METHODS

Experimental Site

The present investigation was conducted during *kharif* season of 2019 at AICRP(Sorghum) research field, KVK, Hardanahalli, Chamarajanagar district, UAS, Bengaluru which comes under the southern dry zone of Karnataka. The station is located at Latitude of $11^0$55'17.40", longitude of N $76^0$56'21.52"E and 787.6m above the mean sea level. The experiment was conducted in black soil with loamy in texture. The soil is with low available nitrogen (218.6kg/ha) and Phosphorus(23.5kg/ha) and medium in available potassium(295 kg/ha).

Experimental details

The Experiment consist of fourteen treatment combination with different legumes *viz*., pigeonpea, blackgram, greengram, cowpea and field bean in different row ratios *viz*., 2:1, 4:1 and 4:2. Legumes were sown as per the treatment combination. The sole sorghum was sown at a spacing of 37.5cm×15cm. The plot size was 3m×4.8 m. The experiment was laid out with Randomized Block Design and replicated thrice.

Fertilizer application

Recommended dose of fertilizer for sorghum was 65:40:40 kg NPK per hectare. Nitrogen was applied in two split. 50% N was applied at the time of sowing and remaining 50% N was applied as top dressing after 30DAS. Full dose of Phosphorous and Potassium were applied at the time sowing. The Nitrogen, Phosphorous and Potassium were applied in the form of Urea, Single super phosphate and Murate of Potash, respectively.

Cultural operations

Thinning out of extra seedling of sorghum was done after 15 DAS. Hand weeding was done twice at 15 DAS and 30 DAS. Earthing up operation was done after 30 DAS.

Observation

Crop was harvested at maturity stage, seed yield per net plot of each treatment was recorded and then converted to kg/ha.

Evaluation of the cropping systems was analyzed by using the following indices

1. Land equivalent ratio (LER)

LER= (Yab/Yaa) + (Yba/Ybb)

where, Yaa and Ybb : pure crop yield of maize and intercrops respectively, Yab and Yba : yield of main crop and intercrops in mixture

2. Area time equivalent ratio

ATER= [(RYa x ta) + (RYb x tb)]/T

where, RY: Relative yield of main crop or intercrop, RYa: Intercrop yield of maize with associated crop / Pure stand yield of maize, RYb: Intercrop yield of associated crop / Pure stand yield of associated crop, t: duration for main crop or intercrop, T: duration of intercropping system.

3. Sorghum equivalent yield (SEY)

SEY= (Grain yield of intercrop/market price of maize) x market price of intercrop

Statistical analysis

The data collected on different parameters during the course of study were subjected to Fishers method of analysis of variance technique (ANOVA) (Gomez & Gomez, 1984). The level of significance used in "F" and "t" test was P = 0.05. Critical difference

(CD) values were worked out for the P = 0.05, whenever "F" test was found significant.

RESULTS AND DISCUSSION

Grain yield

Treatment combination of Sorghum+ Blackgram (4:2) recorded the highest yield of 1593kg/ha (table 1) compare to the other treatments. Increase in the sorghum yield when grown with blackgram at 4:2 row ratio may be due to the complementary effect between base crop and intercrop. Blackgram being a short stature and early maturing crop offered lesser competition for the available resource like solar radiation, water and nutrient compare to the crop like cowpea and field bean which resulted in increase in growth and yield attributes like plant height, number of leaves per plant, dry matter production per plant, ear head length, ear head width and number of grains per ear head which led to increase in the grain yield. These results were in confirmatory with findings of Amedie et al. (2010) and Ananthi et al. (2017).

Economics

Intercropping of Sorghum+Greengram(4:2) recorded significantly highest gross return (Rs. 44,213/ha) and net returns (Rs. 27,434/ha) and B:C ratio(2.64) (Table1) followed by sorghum+blackgram (4:2). Increase in the gross returns, net returns and B:C ratio is due to increase in grain yield of sorghum and higher market price of sorghum and greengram. Similar results were also reported by Patel and Rajagopal (2001) in pigeon pea+ maize (4:2) intercropping system.

LER, ATER and SEY

Land Equivalent Ratio (1.35) and Area Time Equivalent Ratio (1.32) were highest in sorghum+blackgram (4:2) treatment (Table 2). This may be due to difference in growth habits of component crop and base crop and effective utilization of the available resources to produce the higher yields per unit area than that of sole crop. Among the legumes blackgram is found to be most compatible legume for intercropping in sorghum since it is a short duration and fast growing legume. As the legumes have complementary effect on the base crop in terms of increasing the availability of nutrients. These confirmatory results of 4:2 row ratio increases the LER were reported by Patel and Rajagopal (2003) and Dutta and Bandyopadhyay (2006) in cereal+legume cropping systems.

Increase in Sorghum Equivalent Yield (2,544 kg/ha) (Table 2) was recorded in sorghum+greengram (2:1) ratio and lowest was recorded in sole sorghum. This might be due to the increased yield of redgram in intercropping with sorghum and higher market price of the redgram. Similar results were obtained by Dudhade et al. (2009).

Table 1: Response of intercropping of legume in sorghum on the Sorghum yield (kg/ha) and economics

Treatment details	Sorghum yield (kg/ha)	Cost of Cultivation (Rs/ha)	Gross Returns (Rs/ha)	Net returns (Rs/ha)	Benefit: Cost ratio
T_1 - **Sorghum+Redgram(2:1)**	1263	17085	43067	25982	2.52
T_2 -**Sorghum+Greengram(2:1)**	1426	16735	39469	22734	2.36
T_3 -**Sorghum+Blackgram(2:1)**	1448	16735	39343	22608	2.35
T_4 -**Sorghum+Cowpea(2:1)**	1323	16835	33730	16895	2.00
T_5 -**Sorghum+Field bean(2:1)**	1349	16835	32309	15474	1.92
T_6 -**Sorghum+Greengram(4:1)**	1308	16779	33170	16391	1.98
T_7 -**Sorghum+Blackgram(4:1)**	1393	16779	34770	17991	2.07
T_8 -**Sorghum+Cowpea(4:1)**	1085	16879	28973	12094	1.72
T_9 -**Sorghum+Field bean(4:1)**	1159	16879	28052	11173	1.66
T_{10} -**Sorghum+Greengram(4:2)**	1545	16779	44213	27434	2.64
T_{11} -**Sorghum+Blackgram(4:2)**	1593	16779	44025	27246	2.62
T_{12} -**Sorghum+Cowpea(4:2)**	1402	16879	39754	22875	2.36

T_{13} **-Sorghum+Field bean(4:2)**	1410	16879	37060	20181	2.20
T_{14} **-Sole Sorghum**	1452	13555	30360	16805	2.24
Sole Redgram	1490				
Sole greengram	737				
Sole blackgram	742				
Sole cowpea	998				
Sole field bean	915				
SEm±	60				
CD @5%	174				

Table 2: Evaluation of intercropping of legume in sorghum for Land Equivalent Ratio (LER), Sorghum Equivalent Yield (SEY) and Area Time Equivalent Ratio (ATER)

Treatment details	LER	SEY(kg/ha)	ATER
T_1 **- Sorghum+Redgram(2:1)**	1.16	2544	0.89
T_2 **-Sorghum+Greengram(2:1)**	1.18	2078	1.12
T_3 **-Sorghum+Blackgram(2:1)**	1.20	2066	1.18
T_4 **-Sorghum+Cowpea(2:1)**	1.09	1910	1.04
T_5 **-Sorghum+Field bean(2:1)**	1.10	1774	0.99
T_6 **-Sorghum+Greengram(4:1)**	1.08	1879	1.02
T_7 **-Sorghum+Blackgram(4:1)**	1.13	1922	1.12
T_8 **-Sorghum+Cowpea(4:1)**	0.91	1626	0.87
T_9 **-Sorghum+Field bean(4:1)**	0.96	1556	0.86
T_{10} **-Sorghum+Greengram(4:2)**	1.31	2367	1.24
T_{11} **-Sorghum+Blackgram(4:2)**	1.35	2349	1.32
T_{12} **-Sorghum+Cowpea(4:2)**	1.21	2245	1.17
T_{13} **-Sorghum+Field bean(4:2)**	1.23	2045	1.10
T_{14} **-Sole Sorghum**	1.00	1452	1.00
SEm±	0.05	87	0.05
CD @5%	0.14	253	0.13

CONCLUSIONS

From the present study it was reveals that intercropping of blackgram or greengram in row ratio of 4: 2 with sorghum. Increases the sorghum grain yield and economics compare to the other legumes in study.

REFERENCES

Amedie, B., Chittapur, B. M., Halikatti, S. I., & Chimmad, V. P. (2010). Intercropping of Grain Legumes in Sorghum. *Karnataka Journal of Agricultural Sciences*, *17*(1), 22-27.

Ananthi, T., Mohamed Amanullah, M., & Abdel Rahman Mohammad Said Al-Tawaha, (2017). A review on maize-legume intercropping for enhancing the productivity and soil fertility for sustainable agriculture in India. *Advances in Environmental Biology*, *11*(5), 49-63.

Dudhade, D. D., Deshmukh, G. P., Harer, P. N., & Patil, J. V. (2009). Studies on intercropping of pulse crops with pigeonpea under rainfed condition. *Legume Research-An International Journal*, *32*(3), 215-217.

Dutta, D., & Bandyopadhyay, P. (2006). Production potential of intercropping of groundnut (*Arachis hypogaea*) with

pigeonpea (*Cajanus cajan*) and maize (*Zea mays*) under various row proportions in rainfed Alfisols of West Bengal. *Indian Journal of Agronomy*, *51*(2), 103-106.

Gomez, K.A., & Gomez, A.A. (1984). Statistical procedures for agricultural research. A Willey Inter Science Publication, New York (USA).

Patel, J. R., & Rajagopal, S. (2001). Production potential of forage maize (Zea mays) with legumes under intercropping system. *Indian Journal of Agronomy*, *46*(2), 211-215.

Patel, J. R., & Rajagopal, S. (2003). Nitrogen management for production of sorghum (*Sorghum bicolor*) and cowpea (*Vigna unguiculatd*) forage under intercropping system. *Indian Journal of Agronomy*, *48*(1), 34-37.

Sharma, J. (1994). Effect of fertility levels on maize (*Zea mays*)+ legume intercropping system under rainfed condition. *Indian journal of Agronomy*, *39*(3), 382-385.

Undie, U.L., Uwah, D.F., & Atto, E. E. (2012) Effect of intercropping and crop arrangement on yield and productivity of late season maize/soybean mixtures in the humid environment of south southern Nigeria. *J Agric Res 4*(4), 37