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Yield and Economics of Finger Millet with Different Legumes in Koshi Region of Bihar, India

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A B S T R A C T

A field experiment was conducted during the Kharif season of 2019 at Agronomy Instructional Farm, Mandan Bharti Agriculture College, Saharsa, Bihar Agricultural University, Sabour, Bhagalpur, Bihar to evaluate the best finger millet based inter cropping with different legumes. Based on the results, it was concluded that intercropping of finger millet with black gram at 4:2 pair row ratio was distinctly superior among all intercropping system found most profitable by realizing the highest net return. However, yield and yield attributing characters of finger millet were recorded significantly higher in Finger millet intercropped with Black gram followed by groundnut and soybean. . Among the ratio of intercropping system 4:2 ratio of all inter cropping systems recorded higher finger millet equivalent yield along with net income than 6:2 ratio of inter cropping system.

Introduction

Traditional intercropping system is normally followed by many farmers to meet their domestic demands. Selection of crops and cropping systems in relation to soil and climate is a key factor for successful crop production. Intercropping is a system of growing more than one crop species on the same piece of land at the same time. The benefits perceived or realized by intercropping systems include greater land use efficiency improvement in soil fertility. Intern, several factors like cultivar selection, seeding ratios, planting pattern and competition between mixture components affect the growth of species in intercropping (Caballero *et al.*, 1995, Carr *et al.*, 2004). Several legume species including pigeonpea, black gram, groundnut, cowpea, soybean etc. were evaluated for their feasibility as an intercrop. Finger millet (*Eleusine coracana* L. Ganetn) is one of the important rainfed as well as dry land crop and is widely cultivated

throughout country in dry tracks with fewer natural resources. Growing of only cereals is not so much remunerative in present scenario of agriculture to fulfill the diverse demand of consumers and rapid growing population. Intercropping of finger millet with different legumes has grater scope to utilize the land and other resources to maximum extent. The productivity of the system can be enhanced by judicious selection of intercrop differing in duration and growth alone in many situations this is supported by Aravazhi *et al.*, (1997), Natarajan (1992) and Sadashiv and Nemgouda (2004).

Materials and Methods

A field experiment was conducted during the Kharif season of 2019 at Agronomy field unit, Mandan Bharti Agriculture College, Saharsa, Bihar Agricultural University, Sabour, Bhagalpur, Bihar.. The legume crop of Soybean (JS-9752), Black gram (IPU-2-43) and Groundnut (BG-3) were taken as intercrop in finger millet (GPU-67). The intercrops were sown in finger millet in different row proportions of 4: 2 and 6: 2. The row spacing of finger millet, soybean, black gram and groundnut were maintained at 20 cm, 40 cm, 30cm and 40cm respectively .. The legumes crops were sown by dibbling method. The thinning of legume crop was done at 15 days after sowing and only one healthy plant was kept per hill by maintaining the 10 cm spacing between the two plants. The experiment was laid out in randomized block design with three replications. Ten treatments were studied viz., T1- Sole crop of finger millet, T2- Sole crop of Soybean, T3- Sole crop of Black gram, T4- Sole crop of Groundnut, T5- Finger millet + soybean (4:2), T6- Finger millet+ soybean (6:2), T7- Finger millet+ Black gram (4:2), T8 -Finger millet+ Black gram (6:2), T9- Finger millet+ Groundnut (4:2) and T10- Finger millet+ Groundnut (6:2). The gross plot size was 23 x 67 m and net plot of 6.0 x 5.40 m. The 5.0 tones of FYM/ ha with recommended dose of fertilizers (60: 40: 25 kg NPK/ ha) was given to the finger millet crop which was applied through urea and single super phosphate. The crops were sown during the first week of June. Necessary plant protection measures were taken to protect the crop from pest and diseases. The intercultivation two weedings were followed by one hoeing.

Results and Discussion

Yield attributing characters of finger millet

Table 1 show that Productive tillers per hill and earhead length of finger millet were significantly high in sole crop. Among different intercroppings systems Finger millet + Black gram (6:2) row ratio were produced higher number of productive tillers per hill (3.500) and earhead length (9.803) of finger millet. It might be due to lower density of finger millet and wider space available for more growth and development of finger millet as compared to other row ratios. Bengali (1987) and Tiwari *et al*., (2015) reported similar results. Better environment particularly the light interception by outer rows of finger millet in this row ratio lead to higher effective tillers per hill in these treatments or this might be due to development of better complementary relationship and non-renewable resources like water, nutrients and incoming sunlight. These results are in close conformity with the findings of Narasimha Rao *et al*. (1963) and Divakaran (1967).

The maximum number of ears/m^2 (110.0) was observed in T8- Finger millet + Black gram (6:2) which were at par with T7 -Finger millet + Black gram (4:2). The minimum number of ears/m^2 was 92.0 recorded under T5- Finger millet + Soybean (4:2).. This was due to more number of productive tillers in T8 compared to others. This was in accordance with earlier finding of Rajesh (2011) in finger millet.

Table.1 Yield attributing characters of finger millet as influenced by different treatments

Treatments	No of productive tillers/hill	No. of ears/m^2	Length of Ear head (cm)	Wt. of ear head (gm)	No. of fingers /ear	Length of fingers /ear (cm)	No. of grains /ear	Test wt. (gm)
T1- Finger millet (sole)	3.600	111.00	11.000	35.10	8.100	5.600	2401	3.800
T2- Soybean (sole)								
T3 -Black gram (sole)								
T4 -Groundnut (sole)								
T5 –Finger millet+ soybean (4:2)	2.717	92.00	8.567	32.40	7.017	4.630	2117	2.417
T6- Finger millet+ soybean (6:2)	2.867	95.00	8.803	32.70	7.217	4.753	2149	2.633
T7- Finger millet+ Black gram (4:2)	3.217	105.00	9.677	34.30	7.900	5.213	2300	3.233
T8 -Finger millet+ Black gram (6:2)	3.500	110.00	9.803	34.80	8.333	5.460	2395	3.653
T9- Finger millet+ Groundnut (4:2)	2.920	97.00	9.200	33.10	7.420	4.863	2232	2.870
T10- Finger millet+ Groundnut (6:2)	3.053	103.00	9.433	33.50	7.600	5.103	2265	3.050
SEM ±	0.116	0.208	0.139	0.095	0.074	0.100	12.059	0.132
CD at 5%	0.361	0.649	0.432	0.297	0.231	0.312	37.570	0.410

Table.2 Yield and economics of finger millet as influenced by different treatments

Treatments	Grain yield of finger millet (kg/ha)	Finger millet equivalent yield (kg/ha)	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio
T1- Finger millet (sole)	2017	2017	17500	44374	26874	1.53
T2- Soybean (sole)		1843	24700	68191	43491	1.76
T3 -Black gram (sole)		2325	20400	69750	49350	2.41
T4 -Groundnut (sole)		2302	30850	92080	61230	1.98
T5 –Finger millet+ soybean (4:2)	1831	3521	24850	77462	52612	2.11
T6- Finger millet+ soybean (6:2)	1865	3425	25300	75350	50050	1.97
T7- Finger millet+ Black gram (4:2)	1975	4233	24350	93126	68776	2.82
T8 -Finger millet+ Black gram (6:2)	2010	4228	24700	93016	68316	2.76
T9- Finger millet+ Groundnut (4:2)	1905	4013	26450	88286	61836	2.33
T10- Finger millet+ Groundnut (6:2)	1933	3993	26800	87846	61046	2.27
SEM ±	5.893					
CD at 5%	18.360					

However, Weight of ear head, number of fingers /ear, length of fingers/ear, number of grains/ear, test weight, was significantly high in sole crop. Among different intercroppings systems Finger millet + Black gram (6:2) row ratio were produced highest Weight of ear head, number of fingers /ear, length of fingers/ear, number of grains/ear and test weight. These results are in accordance with finding of Rathore and Gautam (2003) and Ramamoorthy *et al.* (2004).

Grain and straw yield

The sole crop of finger millet recorded the highest grain yield (2017 kg/ha) which was significantly superior over rest of the treatments. The grain as well as straw yield reduced considerably when intercropped with legumes in comparison to sole crop of finger millet as reported by Singh and Arya (1999) and Mitra *et al.* (2001). Among all the intercropping system, the maximum yield was recorded in the finger millet intercropped with blackgram followed by groundnut and soybean. However the ratio of 6:2 among all intercropping systems recorded significantly higher grain and straw yield than 4:2 ratio of intercropping systems.

Grain equivalent yield of finger millet

As regards the finger millet grain equivalent yield significantly highest yield (4233 kg/ha) was observed by the treatment T7 where black gram was taken as intercrop in finger millet in 4:2 row proportion. But it was at par with the treatment T8 where black gram was taken as an intercrop in finger millet in 6:2 row proportions (4228 kg/ ha). Similar results were also reported by Thorat *et al.* (1986), Mahadkar and Khanvilkar (1988), Shankarlingappa and Hegade (1992) and Ramamoorthy *et al.* (2004). It indicates that it is beneficial to raise the finger millet with intercrops rather than sole crop alone.

Economics

The results clearly showed that sole groundnut recorded the highest net return than all other sole crops (Table 2). This was mainly due to high price of groundnut. However, the highest benefit/cost ratio was obtained from sole black gram due to high productivity of black gram. The lowest net return and benefit/cost ratio was obtained from sole finger millet, which might be due to low productivity of the crop.

Monetary returns (Table-2) as elucidated by net income were significantly higher in different intercropping systems as compared to sole finger millet. Looking to overall economics all legumes and finger millet with legume intercropping treatments gave significantly higher net realization over that of sole finger millet. This could be attributed to higher yield advantage under sole legumes and intercropping systems. Finger millet + Black gram (4:2) combination gave the highest net return of Rs. 68776 /ha and benefit cost ratio of 2.82 followed by finger millet + Black gram (6:2) which gave net return of Rs. 68316/ha with 2.76 benefit cost ratio which confirmed the superiority of Finger millet with black gram at 4:2 pair row ratio over other treatments. Similar results were also reported by Yadav and Jat (2005).

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