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Evaluation of Millet Based Intercropping System under Rainfed Upland Situation

Humeshwar Kumar, A. K. Thakur*, A. Pradhan, G. K. Sharma and D. P. Singh

Department of Agronomy, SG College of Agriculture and Research Station, Indira Gandhi Agriculture University, Jagdalpur, India

**Corresponding author*

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A B S T R A C T

The study was conducted at New Upland Research cum Instructional (NURI) Farm, Lamker under SG College of Agriculture and Research Station, Jagdalpur, Dist-Bastar (C.G.) during *kharif* season 2019. The experiment was laid out in Randomized Complete Block Design (RBD) with three replications and consists of nine treatments. The soil of experimental field was *Entisols,* with acidic in reaction (pH-5.83), organic carbon was medium, available N and P was low and, available potassium was high. Experimental results revealed that all the growth, yield contributing characters, grass income and net income of millet and pigeonpea were significantly high in sole crop compared to different intercropping systems. The system B:C ratio was significantly high for kodo millet + Pigeon pea 4:1 ratio.

Introduction

Millet is one of the most popular food grain crops grown in almost all tribal belts of the state having poor resource base with the farmers. It is extensively grown under both as a sole and mixed cropping system through broadcast method of sowing. In rainfed conditions it is mostly grown in association with pigeon pea as mixed cropping for minimizing agricultural risks, maximizing productivity and profit besides fulfillment of the domestic needs (grain and pulse) of the growers and improving quality of natural resources particularly soil fertility (Dhandayuthapani *et al.*, 2015). India is the leading producer of small millets namely, finger millet (*Ragi*), kodo millet (*Kodo*), foxtail millet (*Kangni*), barnyard millet (*Sawan*), proso millet (*Cheena*) and little millet (*Kutki*) (Majumdar *et al.*, 2006). In India, minor millets are cultivated mainly as rainfed crops and occupy an area of about 2.7 million ha which is about 12% of the whole area under coarse cereals in the country (Seetharam, 2006).

Materials and Methods

A field experiment was conducted under rainfed condition during kharif season 2019 at Lamker, farm SG College of Agriculture and Research Station, Jagdalpur (C.G.). The general climatic condition of Bastar Plateau is sub-humid. Average annual rainfall

of this area is 1440 mm but during *Kharif* 2009, 2033.00 mm rainfall was received with 78 rainy days and maximum temperature varied from 31.39°C to 26.40°C, whereas, minimum temperature varied from 11.70°C to 23.40°C during the experimentation. *i.e.* T_1- Kodo millet + pigeonpea (4:1), T_2 - Kodo millet + pigeonpea (6:1), T_3- Kodo millet + pigeonpea (8:1), T_4 -Barnyard millet + pigeonpea (4:1), T_5- Barnyard millet + pigeonpea (6:1), T_6- Barnyard millet + pigeonpea (8:1), T_7 - Sole kodo millet, T_8 - Sole barnyard millet and T_9 - Sole pigeonpea.

The experiment consisted of three different pulses and cereals crop viz., kodo millet, barnyard millet and pigeonpea as a sole crop and the variety of sole crop were selection CG kodo-2, VL- 29 and BRG-2 for kodo millet and barnyard millet and pigeonpea respectively. The trial was laid out in a randomized block design with three replications and each gross plot of 5 x 4 m and net plot of 4.5 x 3.5 m. The crops were sown on 28th june 2019 on *Entisoils* upland (red soils). Both the crops were fertilized separately as per the recommendation. The data on Plant height, numbers of tillers plants^{-1} numbers of panicle plants $^{-1}$, panicle length, no of grains panicle^{-1} and for millet crop and numbers of branches plants^{-1} numbers of pods plants^{-1} numbers of seed pods^{-1} and no of pods branches^{-1}. For economics analysis gross income, net income and B:C ratio was calculated.

Results and Discussion

Effect of plant height and yield attribute

The data presented in Table 1 reveals that the plant height was recorded treatment (T_6) statistically taller plant which was significantly at par with treatment Sole barnyard millet (T_8), Barnyard millet + Pigeonpea 6:1 ratio (T_5) and Barnyard millet + Pigeonpea 4:1 ratio (T_4) and small plant was observed in treatment Kodo millet + Pigeonpea 4:1 ratio (T_1). It might be due to the more competition for light within the plant in sole crop.

Similar result was corroborated with Sharmili and Parasuraman (2018), Yadav *et al.,* (2015) and Baldev *et al.,* (2005). Plant height of pigeonpea During the observation period at harvest it was found statistically non significance effect due to different treatment but it was recorded numerically taller plant in treatment (T_9) sole pigeonpea while smallest plant was observed in treatment Barnyard millet + Pigeonpea 8:1 ratio (T_6) at all the growth stages except.

In contrast plant height of pigeonpea was height it might be due to the more plant population per unit area which was increased competition among the plant. Similar result was close conformity with the findings of Sekhon *et al.,* (2018) Sharifi *et al.,* (2009). Numbers of tillers were recorded statistically higher in treatment Sole kodo millet (T_7) among all the treatment. It was due to the more availability of nutrient, moisture and space in sole crop. The similar results are found by Shivaraj *et al.,* (2015), Ram and Meena (2014), Baldev *et al.,* (2003) and Kadalli *et al.,* (1989). Treatment Sole kodo millet (T_7) recorded significantly highest number of panicle per plant and it was found on par with Kodo millet + pigeonpea 4:1 ratio (T_1).

Treatment Sole barnyard millet (T_8) recorded significantly higher panicle length and number of grains per panicle in base crop among all the treatment but it had found on par with Barnyard millet + Pigeonpea 8:1 ratio (T_6) in length of panicle and Barnyard millet + Pigeonpea 6:1 ratio (T_5) and Barnyard millet + Pigeonpea 4:1 ratio (T_4) in number of grain per panicle.

In intercrop, number of branches per plant were found unaffected due to different treatment during one year experiment. This might be due to the efficient utilization of resources and less competition for nutrients as pigeonpea being pulse crop contributes for increased nitrogen availability.

Table.1 Effect of different treatment on Plant height and yield attributing characters of intercropping system

	Base crop					Inter crop				
Treatment	**Plant height (cm)**	**No. of tiller plant^{-1}**	**No. of panicle plant^{-1}**	**Panicle length (cm)**	**No. of grain panicle^{-1}**	**Plant height (cm)**	**No. of branches plant^{-1}**	**No. of pod plant^{-1}**	**No of pods branches^{-1}**	**No. of seed pods^{-1}**
T_1: kodo + pigeonpea (4:1) Ratio	72.25	5.26	5.38	10.42	147.00	171.81	7.83	96.17	7.03	4.32
T_2: kodo + pigeonpea (6:1) Ratio	73.82	5.33	5.12	10.51	149.33	170.41	7.77	95.00	6.70	4.26
T_3: kodo + pigeonpea (8:1) Ratio	74.31	5.53	5.07	10.84	150.33	165.49	7.67	80.4	5.87	3.95
T_4: Barnyard + pigeonpea (4:1) Ratio	128.14	1.66	1.10	13.40	971.81	168.47	7.5	94.67	6.07	4.06
T_5: Barnyard + pigeonpea (6:1) Ratio	128.05	1.73	1.23	13.56	1024.12	166.03	7.50	92.67	5.73	3.93
T_6: Barnyard + pigeonpea (8:1) Ratio	130.68	1.86	1.27	14.66	1039.03	164.06	7.43	76.33	4.88	3.89
T_7: Sole kodo millet	75.39	5.73	5.83	12.08	159.06	-	-	-	-	0.00
T_8: Sole Barnyard millet	130.23	1.93	1.33	15.80	1042.83	-	-	-	-	0.00
T_9: Sole pigeonpea		-	-	-	-	177.05	8.17	102.67	8.38	4.35
SEm±	2.94	0.21	0.16	0.50	38.48	5.04	0.26	5.82	0.50	0.28
CD at 5%	9.00	0.64	0.51	1.55	117.85	NS	NS	NS	1.57	NS
CV %	5.01	9.9	8.08	6.96	11.38	5.16	5.85	11.07	13.71	11.64

Table.2 Effect of different treatment on economics of intercropping system

Treatment	Economics						System B:C Ratio
	Base crop			Inter crop			
	Gross Income (Rs ha^{-1})	Net Income (Rs ha^{-1})	B:C ratio	Gross Income (Rs ha^{-1})	Net Income (Rs ha^{-1})	B:C Ratio	
T_1: Kodo + pigeonpea (4:1) Ratio	34640	20091	2.38	87338	67589	4.28	3.33
T_2: Kodo + pigeonpea (6:1) Ratio	36134	20155	2.48	80234	60484	4.13	3.31
T_3: Kodo + Pigeonpea (8:1) Ratio	38540	23991	2.65	69577	49828	3.51	3.08
T_4: Barnyard + pigeonpea (4:1) Ratio	27100	10661	1.65	71840	52091	3.64	2.65
T_5: Barnyard + pigeonpea (6:1) Ratio	30150	13711	1.83	69604	49854	3.52	2.68
T_6: Barnyard + pigeonpea (8:1) Ratio	31607	15168	1.92	67454	47704	3.42	2.67
T_7: Sole kodo millet	42147	27598	2.90	-	-	-	0.00
T_8: Sole Barnyard millet	35127	18688	2.41	-	-	-	0.00
T_9: Sole pigeonpea	-	-	-	92907	73158	4.70	0.00
SEm±	1064	1090	0.07	3019	1,869.95	0.26	0.07
CD at 5%	3258	3338	0.21	9404	5826	0.81	0.22
CV %	5.35	10.06	5.26	6.83	5.7	10.47	6.45

This result is Patil and Padmani, (2007) and Priyanka and Rajkumar (2019). Number of pods per branches was recorded significantly higher in treatment Sole Pigeonpea (T_9) among all the treatment but it had produced similar result in treatment Kodo millet + Pigeonpea 4:1 ratio (T_1) whereas, number of pods per plant and number of seeds per pods was registered non significance due to different intercropping system. It was differed significantly effect due to influence exerted by different treatments. Similar result was reported by Pradhan *et al.,* (2014). Mallikarjun (2018) more reduction in yield attributes of pigeonpea was found when it was intercropped with nutri-cereal crops in double row ratios than single row ratios due to intense competition effect of greater population pressure of nutri-cereal crops on lesser population of pigeonpea.

Effect of intercropping on economics

The data presented in Table 2, reveals that grass income, net income and B: C ratio found significantly highest in treatment Sole kodo millet (T_7) among the treatment and lowest economics were found in treatment Kodo millet + Pigeonpea 8:1 ratio (T_4). In intercropping system highest grass income, net income and B: C ratio were produced in treatment sole Pigeonpea (T_9) which was on par with treatment Kodo millet + Pigeonpea 4:1 ratio (T_1). The system ratio was recorded significantly highest in treatment Kodo millet + Pigeonpea 4:1 ratio (T_1). It might be due to sole kodo millet produced more yield and fatches higher price in market that is the why economics was higher and in intercropping system sole pigeonpea and kodo millet + pigeonpea 4:1 row proportion produced higher grain yield which was gave more economics yield. These results were corroborated with patil *et al., (*2010) and Tetrawal and Rana (2006).

The base crop was recorded significantly highest Plant height, Number of tillers per plant, number of panicle per plant, panicle length and number of grain per panicle compared to intercropped treatment. Whereas Sole pigeonpea produced highest plant height, number of branches Number of pods per branch, number of pods per plant, number of seeds per pod and system B: C ratio was found highest in Kodo millet + pigeonpea (4:1) ratio (T_1).

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