

Original Research Article

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Sustainable Intercropping Association of Little Millet (*Panicum sumatrense* L.) in Niger (*Guizotia abyssinica* Cass)

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ABSTRACT

Keywords

Intercropping systems, little millet grain equivalent yield, LER.

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A field experiment was conducted at the Zonal Agricultural Research Station, Shenda Park, Kolhapur (Maharashtra) during *kharif* 2016-17 to 2018-9 to study the performance of intercropping of niger oilseed in little millet. The experiment was laid out in randomized completely block design with nine treatment combinations replicated thrice. The three year pooled data revealed that growing of little millet + niger in 4:1 row proportion recorded highest gross (Rs.45156/-) and net monetary returns (Rs.12298/-) with maximum benefit cost ratio (1.37) and little millet grain equivalent yield (10.93 q ha⁻¹) with maximum LER value (1.38) compared to other intercropping treatments. The increased net monetary returns and grain equivalent yield were 54.98 and 4.10 per cent over sole crop of little millet, respectively.

Introduction

Little millet (*Panicum sumatrense* L.) and Niger (*Guizotia abyssinica* cass) are important *kharif* crops on shallow entisols of Sub-montane zone and Ghat zone of Maharashtra. Little millet is quick growing and early maturing crop. Growing of niger crop around the boundaries of farm and as mix crop in little millet crop is common practice particularly in Konkan and Nasik region of Maharashtra. Intercropping of different cereals, millets, pulses and oilseed

crops simultaneously on the same piece of land with or without any row proportion will minimize the risk of crop failures, acts as barrier for pests, improves soil fertility and makes the farmer self-sufficient (Manjunath and Salakinkop, 2017).

In intercropping system, the competitive effects between main and intercrop depends on the rooting pattern, canopy structure and days to maturity. The basic idea of intercropping is not only that two or more crop species grown together can exploit the

resources better than either of them grown separately, but also that the inherent risk in agriculture and more so under rainfed conditions are buffered to some extent called as biological insurance. Mixed or intercropping is common as a means of insurance and risk minimization.

In particular, information on little millet intercropping is not available from Maharashtra, despite the crop is grown at recommended spacing (30 cm) in consideration to all crops taken as intercrop. With these considerations in view, the experiment was conducted to assess the feasibility of raising niger as intercrop with little millet at different row ratios under rainfed conditions on shallow *entisols* of Sub montane and Ghat zone of Maharashtra.

Materials and Methods

The investigation was conducted during *kharif* seasons for three years 2016-17 to 2018-19 at the Zonal Agricultural Research Station, Shenda Park, Kolhapur (Maharashtra) at latitude of 16⁰43' N, longitude 74⁰ 14' E and altitude 574 m above mean sea level. It comes under Sub-montane Zone of Maharashtra. The experimental site was silty loam with pH- 7.20, E.C- 0.15dSm⁻¹, organic carbon 0.48 per cent. The available nutrient status was low in N (210.kg ha⁻¹), medium in P (12.3 kg ha⁻¹) and low in K (155 kg ha⁻¹). The total annual rainfall received during 2016, 2017 and 2018 were 1067.6 mm in 59 rainy days, 972.2 mm in 70 rainy days and 1252.0 mm in 66 rainy days respectively. The dry spell during grand growth phase (33 to 35 MW) affects on yield of crop in all the years. The present experiment was laid out in randomized completely block design with nine treatment combinations replicated thrice. The treatments included in the experiment were T₁- Sole little millet, T₂- Sole niger, T₃- Little millet + niger 2:1, T₄- Little millet +

niger 4:1, T₅- Little millet + niger 6:1, T₆- Little millet + niger 2:2, T₇- Little millet + niger 4:2, T₈- Little millet + niger 6:2 and T₉- Farmers practice. The gross plot size was 4.00 x 3.0 m² and net plot of size was 4.20 m X 2.40 m. The seed rate of 3 kg ha⁻¹ was used for sowing at spacing of 30 cm x 7.5 cm in all treatments. The variety used were Phule Ekadahi and Phule Karala for little millet and niger, respectively. On the same day both the crops were sown. The crop was fertilized with a dose of 20 kg N and 40 kg P₂O₅ ha⁻¹. Nitrogen supplied as urea, phosphorus as SSP. The tabulated data were statistically processed by standard method of analysis of variance for the randomized block design and test of significance as given by Panse and Sukhatme (1985). It was further computed in terms of little millet equivalent yield and land equivalent ratio (LER) as described by Willey (1979). The intercropping system was also evaluated on the basis of different economical parameters *viz.*, gross returns (Rs. ha⁻¹), net returns (Rs. ha⁻¹) and B:C ratio.

Results and Discussion

Growth parameters

The growth parameters of little millet observed in sole and intercropping treatments were differed significantly (Table 1). Growing of little millet as an sole crop with normal row spacing (30 cm) recorded significantly highest plant height (94.9 cm), number of tillers (8.8) and length panicle (28.6). Tripathi and Kushwaha (2013) reported that yield were substantially higher in sole crop than that of intercrop.

Grain and straw yield

The data presented in Table 2 reveals that sole crop of little millet recorded the higher grain and straw yield (9.78 and 13.16 q ha⁻¹), which showed significant superiority over all other

treatments. Amongst intercropping system, significantly more rain yield of little millet yield (7.78 q ha⁻¹) was recorded with the treatment T₄ i.e. little + niger (4:1) than all the treatments except treatments T₆, where it was found at par. As regards to straw yield, significantly higher straw yield of 9.65 q ha⁻¹ was obtained with the treatment T₆ i.e. little + niger (6:1) as compared to other intercropping systems, however it was at par with T₇, T₈ and T₃. The highest value of intercrop yield was observed with the treatment little millet intercropping in 4:1 proportions with niger (1.51 q ha⁻¹). Similar findings were reported by Shashidhar *et al.*, (2000), Ugale *et al.*, (2009) and Patil *et al.*, (2010), Sharmili and Manoharan (2018).

Grain equivalent yield and LER

The significantly higher little millet equivalent yield of 10.93 q ha⁻¹ was recorded with intercropping of little millet + niger in 4:1 than all other intercropping treatments except treatment T₇, where yield found at par with each other. The same treatment (T₄) also observed maximum value of land equivalent

ratio (LER) of 1.38 (Table 3) implying that 38 % more land would be required as sole crops to produce the yield obtained under intercrop situations. The obvious reason for yield advantage in intercropping system was due to the fact that the component crops differed in utilization of growth resources and converting them more efficiently resulting in higher yield per unit area than that produced by the sole crops. These results were in conformity with Prasannakumar *et al.*, (2009), Ugale *et al.*, (2009), Pradhan *et al.*, (2014), Shashidhar *et al.*, (2000), Sharmili and Manoharan (2018)

Economics

The growing of little millet + niger in 4:1 proportion being at par with treatment T₁ i.e. sole little millet registered significantly higher value of gross monetary returns (Rs.45156/-) than all other intercropping systems under pooled mean basis. As regards net monetary returns, three year pooled data revealed that maximum value of Rs.12298/- was noticed with intercropping of little millet + niger in 4:1 (T₄).

Table.1 Pooled mean growth and yield attributing characters of little millet as influenced by different treatments

Treatment	Plant height (cm)	Number of tillers plant ⁻¹	Length of panicle (cm)
T ₁ - Sole Little millet	94.9	8.8	28.6
T ₂ - Sole Niger	-	-	-
T ₃ - Little millet + Niger (2:1)	86.1	8.0	20.9
T ₄ - Little millet + Niger (4:1)	86.3	7.5	25.0
T ₅ - Little millet + Niger (6:1)	90.5	7.5	26.7
T ₆ - Little millet + Niger (2:2)	86.7	7.9	22.5
T ₇ - Little millet + Niger (4:2)	88.1	8.3	25.0
T ₈ - Little millet + Niger (6:2)	89.9	8.5	27.4
T ₉ - Farmers practice	79.8	5.9	18.8
S.E. ±	0.96	0.09	1.18
C.D. 0.05	2.92	0.27	3.57

Table.2 Pooled mean grain and straw yield (q/ha) of little millet as influenced by different treatments

Treatment	Grain yield (q ha ⁻¹)			Pooled Mean	Straw yield (q ha ⁻¹)			Pooled Mean
	2016	2017	2018		2016	2017	2018	
T₁ - Sole Little millet	10.80	9.76	8.77	9.78	14.04	12.99	12.46	13.16
T₂ - Sole Niger	3.06	3.02	2.66	2.91	3.60	3.50	3.40	3.50
T₃ - Little millet + Niger (2:1)	5.22	4.42	3.92	4.52	9.68	9.38	7.90	8.99
T₄ - Little millet + Niger (4:1)	8.07	7.86	7.41	7.78	7.40	6.74	9.75	7.96
T₅ - Little millet + Niger (6:1)	8.20	7.71	7.12	7.68	10.67	8.89	9.39	9.65
T₆ - Little millet + Niger (2:2)	5.63	5.72	5.23	5.53	7.31	7.03	7.03	7.13
T₇ - Little millet + Niger (4:2)	7.83	7.43	6.93	7.40	10.18	9.39	8.65	9.41
T₈ - Little millet + Niger (6:2)	7.74	7.13	6.88	7.25	10.06	9.19	8.47	9.24
T₉ - Farmers practice	6.75	6.72	5.98	6.48	8.79	7.61	7.36	7.92
S.E. ±	0.44	0.58	0.63	0.16	0.54	0.62	0.67	0.47
C.D. 0.05	1.35	1.76	1.90	0.47	1.64	1.87	2.03	1.43

Table.3 Pooled mean intercrop yield (q/ha) and LER of little millet as influenced by different treatments

Treatment	Intercrop yield (q ha ⁻¹)			Pooled Mean	LER			Pooled Mean
	2016	2017	2018		2016	2017	2018	
T₁ - Sole Little millet	--	--	--	--	1.00	1.00	1.00	1.00
T₂ - Sole Niger	3.06	3.02	2.66	2.91	1.00	1.00	1.00	1.00
T₃ - Little millet + Niger (2:1)	1.04	1.16	1.23	1.14	1.03	0.85	0.92	0.93
T₄ - Little millet + Niger (4:1)	1.42	1.56	1.56	1.51	1.35	1.34	1.45	1.38
T₅ - Little millet + Niger (6:1)	0.45	0.53	0.56	0.51	0.91	0.98	1.04	0.98
T₆ - Little millet + Niger (2:2)	0.97	1.06	1.26	1.10	1.15	0.94	1.08	1.06
T₇ - Little millet + Niger (4:2)	0.94	0.97	0.97	0.96	1.06	1.11	1.18	1.12
T₈ - Little millet + Niger (6:2)	0.78	0.85	0.85	0.83	0.98	1.01	1.12	1.04
T₉ - Farmers practice	0.46	0.52	0.53	0.50	0.78	0.87	0.88	0.84
S.E. ±	--	--	--	--	--	--	--	--
C.D. 0.05	--	--	--	--	--	--	--	--

Table.4 Pooled gross monetary returns (Rs ha⁻¹) and LMGEY (q/ha) of little millet as influenced by different treatments

Treatment	Gross monetary returns (Rs ha ⁻¹)			Pooled Mean	LMGEY (q ha ⁻¹)			Pooled Mean
	2016	2017	2018		2016	2017	2018	
T ₁ - Sole Little millet	44599	45495	40714	43603	14.00	11.31	9.05	10.50
T ₂ - Sole Niger	21803	22414	19933	21383	3.11	6.18	2.66	3.98
T ₃ - Little millet + Niger (2:1)	28855	28927	27661	28481	7.21	7.23	6.15	6.86
T ₄ - Little millet + Niger (4:1)	43249	46151	46067	45156	10.81	11.75	10.24	10.93
T ₅ - Little millet + Niger (6:1)	37028	39251	37181	37820	9.26	9.82	8.26	9.11
T ₆ - Little millet + Niger (2:2)	30005	33889	33698	32581	7.50	8.47	7.49	7.83
T ₇ - Little millet + Niger (4:2)	38929	41193	39383	39835	9.73	10.30	8.75	9.59
T ₈ - Little millet + Niger (6:2)	37463	38917	38158	38179	9.37	9.73	8.48	9.19
T ₉ - Farmers practice	31095	34633	31609	32446	7.77	8.66	7.02	7.82
S.E. ±	1944	1944	2992	710	--	0.61	0.66	0.31
C.D. 0.05	5826	5826	8967	2127	--	1.84	1.97	0.93

Table.5 Pooled net monetary returns (Rs ha⁻¹) and B: C ratio as influenced by different treatments

Treatment	Net monetary returns (Rs ha ⁻¹)			Pooled Mean	B : C Ratio			Pooled Mean
	2016	2017	2018		2016	2017	2018	
T ₁ - Sole Little millet	11284	11910	7935	10376	1.34	1.36	1.24	1.31
T ₂ - Sole Niger	-11512	-10901	-12847	-11753	0.65	0.67	0.61	0.64
T ₃ - Little millet + Niger (2:1)	-4460	-4388	-5119	-4656	0.87	0.87	0.84	0.86
T ₄ - Little millet + Niger (4:1)	9935	13671	13287	12298	1.30	1.41	1.41	1.37
T ₅ - Little millet + Niger (6:1)	3713	5969	4401	4694	1.11	1.18	1.13	1.14
T ₆ - Little millet + Niger (2:2)	-3310	574	918	-606	0.90	1.02	1.03	0.98
T ₇ - Little millet + Niger (4:2)	5614	7878	6603	6698	1.17	1.24	1.20	1.20
T ₈ - Little millet + Niger (6:2)	4149	5602	5377	5043	1.12	1.17	1.16	1.15
T ₉ - Farmers practice	715	4254	1679	2216	1.02	1.14	1.06	1.07
S.E. ±	--	--	--	--	--	--	--	--
C.D. 0.05	--	--	--	--	--	--	--	--

The same treatment i.e. T₄ also showed its superiority and recorded highest benefit cost ratio value of 1.37 as compared all other intercropping treatments.

The increased gross and net returns and B: C ratio in intercropping system was mainly due to higher little millet rain yield. These results are in conformity with findings of by

Shashidhar *et al.*, (2000), Patil *et al.*, (2010). Ugale *et al.*, (2009), Sharmili and Manoharan (2018). From these three year pooled data, it could be concluded that growing of little millet + niger in 4:1 row ratio is the most efficient and profitable intercropping system on shallow entisols of Sub-montane zone of Maharashtra.

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