

Effect of moisture conservation practices on growth and yield of pearl millet + pigeonpea intercropping system

R.L. Rajput and N.S. Bhadouriya*

Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya,
Gwalior-474 002, Madhya Pradesh, India.

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ABSTRACT

A field experiment was conducted during *kharif* season of 2012 and 2013 to study the effect of moisture conservation practices on growth and yield attributes of pearl millet + pigeonpea intercropping system under rainfed condition in Madhya Pradesh. On the basis of two years pooled data results revealed that green leaf manure with maize residue mulch treatment recorded higher plant height (110.3cm), more number of tillers per plant (8.4), higher ear length (12.4cm) and grain weight (33.5g) in pearl millet. Similar treatment recorded higher pigeonpea plant height (140.44cm), primary branches (8.83), higher number of pods (90.3) and pod weight per plant (79.62g). The magnitude of improvement in grain yield of pearl millet and pigeonpea was 30.18 and 99.9% respectively, by green leaf manure with maize residue mulch compared to control. Similarly PMEY, net return and benefit cost ratio were also higher in green leaf manure with maize residue mulch over control.

Key words: Green leaf manure, Intercropping, Moisture Conservation, Mulch, Pearlmillet equivalent yield, Pearlmillet, Pigeonpea.

INTRODUCTION

Indian agriculture is dominated by rainfed farming. Rainfed agriculture contributes to 42% of the national food grain production mainly through sorghum, millets and pulses, therefore dryland areas are important for the economy of the country and will continue to be so in future. Crop grown in rainfed condition are prone to water stress, owing to rapid loss of soil water from profile resulting in low water availability for root growth, Moisture conservation practices changes its structure, controls the weeds and improves the water holding capacity of soil (Yadav *et al.* 2008).

Under intercropping situation, replacing certain rows of base crop with intercrop is ideal for reducing the competition under rainfed situation. The proportion of intercrop to the base crop is an important factor in minimising the risk to the base crop during adverse weather conditions and to optimize the yield. Pigeonpea as an intercrop with pearlmillet would increase the productivity of soil and also cropping system besides, helping for protein supplementation to the farmers. Under extreme situations of dryspell, pigeonpea acts as an insurance for sustenance of dryland farmers. Adoption of soil and moisture conservation practices would improve the stability of interactions in dryland situation against the vagaries of monsoon. In India, pearl millet is grown in area of 9800 million ha. While in Madhya Pradesh is grown in area of 0.15 million ha. under rainfed situation. Hence, the study was undertaken to differentiate

the efficacy different soil moisture conservation practices on growth and yield of pearlmillet + pigeonpea intercropping system.

MATERIALS AND METHODS

An experiment was conducted at RVSKVV, Collage of Agriculture Farm, Gwalior during *Kharif* 2012 and 2013. The experimental soil was sandy clay loam in texture having organic carbon 0.45%, pH 6.8, EC 0.10(dsm⁻¹), available nitrogen 225 kg ha⁻¹, available P₂O₅ 20 kg ha⁻¹ and available K₂O 175 kg ha⁻¹. The field experiment was carried out in Pearlmillet + pigeonpea (8:2) intercropping with moisture conservation furrow in between two rows of pigeonpea and laid out in randomized block design with 7 treatments *viz.* T₁ mulching with maize residue@2.5tha⁻¹, T₂ mulching with maize residue@5tha⁻¹, T₃ repeated intercultivation(three times), T₄ green leaf manure @ 10t ha⁻¹, T₅ green leaf manure @ 10t ha⁻¹ + mulching with maize residue@2.5tha⁻¹, T₆ green leaf manure @ 10t ha⁻¹ + repeated intercultivation (three times) and T₇ control-recommended practice with 3 replications. The gross plot size was 6.0m x 3.6m. Pearlmillet variety JBV-2 and pigeonpea variety JKM 189 was sown during first week of July. Calculated quantity of ex-situ green manure (Gliricidia) for green manuring in T₄ T₅ and T₆ treatments was incorporated as per treatments schedule 15 days prior sowing and maize residue straw was analysed for the nutrient stats before mulching. Calculated quantity of sun dried maize residue was mulched in T₁ T₂ T₅

*Corresponding author's e-mail: nsbhadouriya@yahoo.in

and T₆ as per the treatment details on 20 DAS. In the treatment T₃ and T₆ having repeated inter cultivation (Three intercultivation) were adopted including the common inter cultivation. Pearlmillet was harvested on IInd week of October and Pigeonpea was harvested on IInd week of February during both the years. Growth and yield attributes parameters of both the crops of the systems were recorded at the time of harvesting. The yield of Pigeonpea was converted in to Pearl millet seed equivalent yield of pigeonpea with its prevailing market price and divided by price of pearl millet seed. The data were analysed as per procedure suggested by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

Growth and yield attributes of pearl millet: On the basis of two years pooled data combination of green leaf manure with maize residue mulch treatment showed significantly increased plant height (15.3%) and more number of tillers (36.9%) as compared to control. Similar trend was also followed in yield attributes like higher ear length (28.2%) and grain weight (20.5%) over control (Table 1). Increased growth and yield character of pearl millet in green leaf manure with maize residue mulch treatment might be attributed to improve moisture holding capacity of the soil besides reduced evaporation losses with mulching. Similar results were also observed by Chaudhary *et al.*, (2008); Mallareddy *et al.* (2015) and Yadav *et al.* (2015).

Growth and yield attributes of pigeonpea: On the average of two year data revealed that green leaf manure with maize

residue mulch recorded higher plant height (14.4%) and number of primary branches (36.4%) as compared to control. Higher number of pods (24%) and pod weight per plant (28.6%) registered with green leaf manure with maize residue mulch over control (Table 2). The significant improvement in growth and yield components in green leaf manure with maize residue mulch might be attributed to its beneficial effect on physical and chemical properties of the soil, besides supplying essential nutrients to plant growth. This also could be further attributed to ability of plants to absorb the required moisture and nutrients as per its requirement resulting in better yield component and grain yield of Pigeonpea. Similar results were found by Anonymous (2012) in moong bean; Karunakaran and Behera (2013) in Soybean; Rawat *et al.* (2015) and Shyam (2015) in clusterbean + pearl millet intercropping.

Yield of pearl millet and pigeonpea: Green leaf manure with maize residue mulch produced higher pearl millet grain yield followed by green leaf manure with repeated inter-cultivation. While lower yield was obtained in control. The magnitude of improvement in grain yield of pearl millet by green leaf manure with maize residue mulch application was to the tune of 30.68% over control (Table 3). Similar trend was also observed with stover yield of pearl millet. Rajashekarappa *et al.* (2014) also observed 15-54% improvement in maize yield with moisture conservation practices compared to control. In-situ moisture conservation practices significantly increased the stover yield of sorghum

Table 1: Effect of moisture conservation practices on growth and yield attributes of pearl millet.

Treatments	Plant height (cm)	No of tillers (hill ⁻¹)	Ear length(cm)	Grain weight (g hill ⁻¹)
T ₁	Mulching with maize residue @2.5 tha ⁻¹	101.4	6.2	30.6
T ₂	Mulching with maize residue @5 tha ⁻¹	103.6	6.9	30.9
T ₃	Repeated inter cultivation (Three times)	99.5	5.8	28.4
T ₄	Green leaf manure @ 10tha ⁻¹	104.2	7.1	31.3
T ₅	T ₄ + T ₁	110.3	8.4	33.5
T ₆	T ₄ + T ₃	105.2	7.6	31.8
T ₇	Control (Recommended Practice)	93.4	5.3	26.6
	SEm±	1.52	0.36	0.88
	C.D. at%	4.50	1.08	2.66

Table 2: Effect of moisture conservation practices on growth and yield attributes of Pigeonpea.

Treatments	Plant height(cm)	No of primary branch(hill ⁻¹)	No of pods plant ⁻¹	Pod weight g plant ⁻¹
T ₁	Mulching with maize residue @2.5 tha ⁻¹	125.20	6.50	61.10
T ₂	Mulching with maize residue @5 tha ⁻¹	125.81	6.91	63.20
T ₃	Repeated inter cultivation (Three times)	122.64	5.42	59.63
T ₄	Green leaf manure @ 10tha ⁻¹	135.72	7.84	75.41
T ₅	T ₄ + T ₁	140.44	8.83	79.62
T ₆	T ₄ + T ₃	136.82	8.26	77.45
T ₇	Control (Recommended Practice)	120.22	5.61	56.81
	SEm±	3.6	0.44	0.92
	C.D. at%	10.8	1.33	2.77

Table 3: Effect of moisture conservation practices on yield of Pearlmillet and pigeonpea.

Treatments	Pearl millet		Pigeonpea		PMEY (kg ha ⁻¹)	Net return (kg ha ⁻¹)	B:Cratio
	Grain Yield (kg ha ⁻¹)	Stover yield (kg ha ⁻¹)	Grain Yield (kg ha ⁻¹)	Stalk yield (kg ha ⁻¹)			
T ₁ Mulching with maize residue @2.5 tha ⁻¹	3722	6364	323	1051	4664	16278	1.79
T ₂ Mulching with maize residue @5 tha ⁻¹	3831	6457	342	1072	4829	17365	1.83
T ₃ Repeated inter cultivation (Three times)	3512	5448	286	965	4346	14389	1.70
T ₄ Green leaf manure @ 10tha ⁻¹	3962	6836	392	1099	5105	18270	1.85
T ₅ T ₄ + T ₁	4084	7066	425	1115	5324	20443	2.00
T ₆ T ₄ + T ₃	3991	6937	396	1089	5146	19581	1.95
T ₇ Control (Recommended Practice)	3125	5515	212	845	3743	11446	1.57
SEm±	103.40	307.5	4.20	34.21	-	-	-
C.D. at%	310.22	923.5	12.60	102.63	-	-	-

PMEY:Pearlmillet equivalent yield

as reported by Rao *et al.* (2010), Yadav *et al.* (2015) and Kumar *et al.* (2006).

Similar treatment produced higher Pigeonpea seed yield followed by green leaf manure with repeated inter-cultivation treatment. While, lower seed yield was recorded with control. The magnitude of yield improvement in seed yield with green leaf manure with maize residue mulch and repeated inter cultivation treatment to the tune of 99.9 and 86.79%, respectively, over control (Table 3). Similar findings were reported in earlier study by Tamak *et al.* (1994) in lentil.

Pearlmillet equivalent yield (PMEY) and economics: The higher pearlmillet equivalent yield (5324 kgha⁻¹) was observed in green leaf manure with maize residue mulch compared to control. Higher pearlmillet equivalent yield might be due to availability of sufficient moisture and nutrients to the crop compared to control. Similarly higher net return (₹ 20443 ha⁻¹) and benefit cost ratio (2.0) were recorded in green leaf manure with maize residue mulch as compared to control. Karunakaran and Behera (2013) reported similar results.

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