International Journal of Forestry and Crop Improvement
Volume 3 | Issue 2 | December, 2012 | 144-146

Research Article

Influence of row ratios and fertility levels on yield attributes and yield of pearlmillet – greengram intercropping system and nutrient status of the soil

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ABSTRACT : A field experiment was conducted at College Agronomy Farm, B.A. College of Agriculture, Anand Agricultural University, Anand during summer, 2011 comprising four intercropping treatments *i.e.* pearlmillet sole, pearlmillet+greengram, 1:1, pearlmillet+greengram, 2:1, pearlmillet+greengram, 1:2 and three fertility levels *viz.,* 50 per cent RDF, 75 per cent RDF and 100 per cent RDF. The grain and stover yields of pearlmillet were significantly higher under pearlmillet sole followed by pearlmillet+greengram 2:1. However, pearlmillet + greengram 1:2 gave maximum seed and stover yields of greengram and recorded significantly higher pearlmillet equivalent yield than other systems.Application of 100 per cent RDF recorded significantly the highest yield of pearlmillet and greengram and recorded significantly higher pearlmillet equivalent yield than other treatments.

KEY WORDS : Pearlmillet, Seed yield, Protein content

How to cite this Article : Varia, S.D. and Sadhu, A.C. (2012).Influence of row ratios and fertility levels on yield attributes and yield of pearlmillet – greengram intercropping system and nutrient status of the soil, *Internat. J. Forestry & Crop Improv.,* **3** (2) : 144-146.

Article Chronical : Received : *17.09.2012;* Revised : *25.10.2012;* Accepted : *18.11.2012*

INTRODUCTION

Pearlmillet, locally called as bajra is an important dual purpose crop as its grain is used for human consumption and its fodder as cattle feed. Shortage of pulses and oilseeds in the country have focused the attention on intercropping systems, which have also the capacity to improve the physical, biological and chemical properties of the soil. Intercropping of pearlmillet with legumes may increase the productivity per unit area and avoids the risk of failure of crops. Fertilizer management is one of the important cost effective factors known to augment the crop production. Hence, inclusion of legumes in any intercropping system has becomes imperative with the overall view of maintaining soil fertility and for economizing fertilizer use.

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EXPERIMENTAL METHODS

The field experiment was conducted during summer season of the year 2011 at B. A. College of Agriculture, Anand Agricultural University, Anand. The experimental soil was low in available nitrogen (198 kg ha^{-1}), medium in available phosphorus (40.3 kg ha^{-1}) and high in available potassium (341 kg ha^{-1}). The experiment was laid out in factorial randomized block design with 12 combinations comprising of four intercropping treatments (pearlmillet sole, pearlmillet + greengram 1:1, pearlmillet + greengram 2:1 and pearlmillet + greengram 1:2) and three fertility levels (50%, 75% and 100% of RDF) replicated four times. The pearlmillet variety GHB-558 and greengram variety Meha were used as a test varieties. Sole plating of pearlmillet was done at 45 x 10 cm. Fertilizer application

was done on area basis as per treatment to both the crops (RDF is 120-60-0 kg and 20-40-0 kg NPK/ha for pearlmillet and greengram, respectively). Sowing was done on 1st March and harvesting was done on 25th May,2011 for pearlmillet and 30th May, 2011 for greengram.

EXPERIMENTAL RESULTS AND ANALYSIS

The results obtained from the present study have been presented under following heads:

Effect of intercropping on growth and yield:

Pearlmillet sole recorded significantly the highest grain (3758 kg ha^{-1}) and straw (7280 kg ha^{-1}) yields than other treatments (Table 1). Significantly the lowest grain (2344 kg ha^{-1}) and straw (4428 kg ha^{-1}) yields were noticed under pearlmillet + greengram at 1:2 row ratio. The higher yield in sole pearlmillet might be due to higher plant stand and grain yield per plant plant (Table 2). The reason for lower yield under pearlmillet + greengram at 1:2 treatment was may be due to lower plant stand and higher competition for resources like space, light, plant nutrients and moisture. The results corroborate with the findings of Gadhia and Khanpara (1994), Baldevram *et al.* (2005), Kumar *et al*. (2006) and Choudhary (2009).

Significantly the highest seed (592 kg ha^{-1}) and straw (972 kg ha^{-1}) yields of greengram were recorded under pearlmillet + greengram 1:2 (Table 1), while the lowest seed (377 kg ha^{-1}) and straw (562 kg ha^{-1}) yields of greengram were produced under pearlmillet + greengram 2:1. This variation was due to decrease in plant density under pearlmillet + greengram 2:1 treatment when grown as intercrop with pearlmillet and higher competition among pearlmillet and intercrop for natural resources like soil moisture, plant nutrient, space and sunlight responsible for higher photosynthesis rate resulting lower accumulation of dry matter. These results are closely followed by Choudhary (2009) and Tomar and Saini (1979).

Significantly the highest pearlmillet grain equivalent yield (5901 kg ha^{-1}) was produced when pearlmillet was intercropped with greengram at 1:2 row ratio (Table 1). This might be due to additional advantage of intercrop yield due to better complementary relationship resulted in the highest pearlmillet equivalent yield. Pearlmillet equivalent yield was also significantly higher in 1:1, 2:1 intercropping ratios than that of sole pearlmillet. Protein content of pearlmillet was increasing with increasing proportion of greengram and was found significantly the highest (10.72%) in pearlmillet+ greengram 1:2 (Table 1). These finding are in conformity with those reported by Shrivastava *et al.* (1996), Ramulu *et al.* (1998), Baldevram *et al.* (2005), Kumar *et al.* (2006), Choudhary (2009) and Hooda *et al.* (2004).

Effect of intercropping on plant height and earhead length were found non-significant (Table 2), Treatment I_4 (pearlmillet+ greengram 1:2) recorded significantly higher effective tillers plant^{-1} (3.50) than other treatments. Grain yield per plant of pearlmillet was found significantly higher in case of sole pearlmillet . Various treatments of intercropping failed to reach at significant level in case of the 1000-grain weight (Table 2), while available nitrogen was significantly influenced by intercropping treatments and found the highest in treatment I_4 (pearlmillet + greengram 1:2)

Table 1 : Effect of intercropping and fertility levels on yield, quality and economics

Treatments	Pearlmillet		Greengram		Pearlmillet grain equivalent yield (kg ha^{-1})	Net realization (Rs ha^{-1})	Protein content (%)		BCR
	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})			Pearlmillet	Greengram	
Intercropping (Row ratios)									
I_1 (Sole)	3758	7280	-	-	3758	21869	9.31	_	1.95
I_2 (1:1)	2506	5178	492	821	5458	37232	9.72	22.74	2.54
I_3 (2:1)	2949	6071	377	562	5217	35976	9.68	22.89	2.54
I_4 (1:2)	2344	4428	592	972	5901	40458	10.72	23.34	2.62
S.E. ±	78.64	213.21	10.33	28.41	102.06	-	0.28	0.18	-
C.D. (P=0.05)	226.27	613.47	30.16	82.94	293.66	-	0.80	NS	-
Fertility levels (kg ha^{-1})									
F_1 (50% RDF)	2695	5307	444	746	4696	37213	9.64	22.92	2.60
F_2 (75% RDF)	2881	5738	495	770	5111	41957	9.79	23.01	2.76
F_3 (100%RDF)	3092	6174	522	839	5442	45602	10.15	23.04	2.86
S.E. ±	68.11	184.65	10.33	28.41	88.39	-	0.24	0.18	-
C.D. (P=0.05)	195.96	531.28	30.16	82.94	254.32	-	NS	NS	-
I x F	Sig	NS	NS	NS	NS	-	NS	NS	-
C.V. %	9.42	12.87	7.34	12.53	6.95		9.73	2.69	-
Mean	2892	5740	487	785	5083	-	9.9	23.0	-

Table 2 : Growth, yield attributes and available N and P_2O_5 as influenced by intercropping and fertility levels

Treatments	Pearlmillet				Seed yield plant^{-1} (g)	Test weight (g)	Av. N (kg ha^{-1})	Av. P_2O_5 (kg ha^{-1})
	Plant height at harvest (cm)	Earhead length (cm)	Effective tillers plant^{-1}	Grain yield plant^{-1}				
Intercropping (Row ratios)								
I_1 (Sole)	187.5	23.6	3.19	35.87	_	7.23	180.58	39.10
I_2 (1:1)	182.5	23.1	3.18	32.94	7.38	7.15	181.33	38.93
I_3 (2:1)	184.9	22.7	3.16	33.88	7.46	6.98	183.33	38.72
I_4 (1:2)	185.3	25.7	3.50	32.73	7.82	7.07	202.42	38.74
S.E. $\pm$	3.70	0.85	0.08	0.77	0.20	0.13	3.25	0.78
C.D. (P=0.05)	NS	NS	0.23	2.21	NS	NS	9.35	NS
Fertility levels (kg ha^{-1})								
F_1 (50% RDF)	180.4	23.2	3.17	32.28	7.25	7.08	182.88	39.30
F_2 (75% RDF)	183.3	23.8	3.21	33.24	7.36	7.10	187.94	37.63
F_3 (100%RDF)	191.5	24.3	3.40	36.04	8.06	7.14	189.94	39.69
S.E. $\pm$	3.21	0.74	0.07	0.67	0.20	0.11	2.82	0.68
C.D. (P=0.05)	9.23	NS	0.20	1.92	0.58	NS	NS	NS
I x F	NS	NS	NS	Sig.	NS	NS	NS	NS
C.V. %	6.93	12.41	8.49	7.87	9.13	6.34	6.02	6.97
Mean	185	23.8	3.3	33.9	7.6	7.1	186.9	38.9

NS=Non-significant

Effect of fertility levels:

Application of 100 per cent RDF produced significantly the highest grain yield (3092 kg ha^{-1}) of pearlmillet among the different fertility levels while, 75 per cent RDF and 50 per cent RDF remained at par with each other (Table 1). It might be due to the fact that fertilization made the plants more efficient in photosynthetic activity and thereby enhancing carbohydrate metabolism in the plant. The differences for straw yield between application of 100 per cent RDF and 75 per cent RDF as well as between 75 per cent RDF and 50 per cent RDF were found non significant, but 100 per cent RDF and 50 per cent RDF significantly differed from each other. This results matched with the findings of Hooda *et al.* (2004).

Plant height of pearlmillet was increased significantly with increase in fertility levels and was found the highest (191.5cm) in 100 per cent RDF (Table 2). No. of effective tillers per plant was also significantly higher in the same treatment (Table 2). The beneficial effects of yield attributes were also reflected on grain yield (Table 1). The effect on protein content of both the crops was non-significant due to fertility levels. Various treatments of intercropping failed to reach at significant level in case of the 1000-grain weight and the available nitrogen and phosphorus content of the soil.

Economics:

Among the different intercropping treatments, pearlmillet+ greengram 1:2 fetched maximum net realization (40458 Rs. ha^{-1}) and BCR (2.62). Amongst the fertility levels, 100 per cent RDF accrued maximum net realization (45602 Rs. ha^{-1}) and BCR (2.86).

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