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Addition of Nutrients through Leaf Litter Biomass of Intercrops as Influenced by Intercropping, Weed Control and Fertility Management Practices in Rainfed Cotton Based Systems

Abstract

A field experiment was carried out at the Research Farm of Agronomy Department, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS) during 2007-08 and 2008-09 with an object to quantify the fallen leaf litter biomass of intercrops and their nutrient addition to the soil in cotton based cropping systems under rainfed condition. Results revealed that the intercropping of cotton + pigeonpea nearly followed by cotton + marigold produced significantly higher values for fallen leaf litter biomass of pigeonpea and marigold and addition of nutrients to the soil. Normal weeding and increased fertility levels to base crop of cotton significantly increased leaf litter biomass production and nutrient addition to the soil during the experimentation.

Keyword: Leaf Litter, Biomass, NPK, Intercropping, Weed Control, Fertility Management etc

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Introduction

Cotton is an important fiber and cash crop of our country. Monocropping of cotton is risky because of uncertain and uneven distribution of monsoon rainfall Traditionally, cotton + pigeonpea is a common intercropping practice of Central India adopted by most of the farmers as risk covering system. Inspite of taking long duration crop like pigeonpea, other short duration non competitive legumes, oilseed, vegetables and flowers etc. are possible to test in rainfed cotton. Many workers have tested them separately in different cropping systems and reported their monetary benefits with or without nutrient addition through leaf litter biomass/ season. On this important issue, not much attention has been given to quantify the cost free waste, unconsidered and unused crop wise plant parts like, fallen leaf litter, petiole, branches, flower buds and roots biomass production and their contribution in addition of nutrients to the soil. Quantification not only gives the information on dry weight of fallen biomass but also say about saving of money expenditure on purchase of expensive inputs like fertilizers and their application to the next crop.

Considering the meager information available, the attempt has been made to quantify the fallen leaf litter biomass production of intercrops tried in rainfed cotton based systems and their contribution in addition of nutrients to the soil.

Materials and Methods

A field experiment was carried out at the Agronomy Research Farm, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS) during kharif 2007-08 and 2008-09. The experimental site was fairely leveled and uniform in topography. The soil was medium black cotton belonging to vertisols. It was clayey in texture and moderately alkaline in nature (pH 8.3). As regards nutrient status it is medium in organic carbon (0.51%) and available potassium (239.41 kg ha-1), low in available nitrogen (169.76 kg ha-1) and phosphorous (28.68 kg ha-1) and slightly calcarious.

The total rainfall received during 2007-08 in 23rd- 52nd MW at Akola centre was 771.00 mm in 43 rainy days, it was said to be normal year. Wereas, during 2008-09 the total rainfall recorded was 528.20 mm in 42 rainy days and it was stated to be abnormal year. Rainfall was deficit by 30.70% as against normal rainfall of 762.80 mm. Soon after

sowing to flowering and boll development stage deficit rain had adversely affected the cotton yields. AKH-8828 an American hirsutum variety was used for the experiment. It has a bushy, branchy growth habbit attaining the height of about 70-80 cm, 2-4 monopodias, 12-20 sympodias, 50% flowering at 70-75 and 50% boll bursting at 120-125 days after sowing. Crop duration is 170-180 days and average yield is 12-14 q ha-1 under rainfed condition. The intercrops and their varieties popular among the farmers of this area were used in replacement series of experiment and adopted spacing of 45 × 10 cm for drilling and 45 × 30 cm for dibbling by reducing the recommended spacing of 60 × 30cm and plant population of cotton (Anonymous, 2007).

In all, treatment combinations were 36 with 12 main plots (A) Intercropping (6): viz., I1 - Cotton + blackgram (1:1), I2 - Cotton + soybean (1:1), I3 - Cotton + pigeonpea (6:2), I4 - Cotton + clusterbean (1:1), I5 - Cotton + cowpea (1:1) and I6 - Cotton + marigold (1:1) and (B) Weed management (2): W1- No weeding and W2 – Normal weeding at 25 and 50 days after sowing and their Sub plots (3): F1 – 75 % RDF (37.5,18.75, 18.75 kg ha-1) to base crop of cotton, F2 – 100 % RDF (50, 25, 25 kg ha-1) to base crop of cotton and F3 – 125 % RDF (62.5, 31.25, 31.25 kg ha-1) to base crop of cotton. The experiment was laid out in a split plot design with three replications and crop was sown at the spacing of 45 × 30 cm distance. The gross plot size was 6.30 m × 360 m, while net plot size was 5.40 m × 3.00 m and recommended dose of fertilizers of cotton was 50, 25, 25 kg NPK ha-1 with no fertilizers to intercrops.

Results and Discussion

Data presented in Table1, indicated that the average leaf litter biomass production of intercrops was observed more (491.62 kg ha-1) in cotton based systems during 2008-09.

Fallen Leaf Litter Biomass Production of Intercrops in Cotton Based Systems

Effect of Intercropping

Intercropping of cotton + pigeonpea recorded significantly superior leaf litter biomass of pigeonpea over rest of the treatments during both the years of experimentation. It might be because of complementary effects of cotton on growth and development of pigeonpea that favoured to produce more leaf litter biomass. The second and third best position in producing significantly more leaf litter biomass of marigold and blackgram and clusterbean were recorded by the intercropping of cotton + marigold, cotton + blackgram and cotton + clusterbean during 2007-08 and 2008-09 respectively. While, remaining treatments showed more or less equal leaf litter biomass production during the years of experimentation.

Effect of Weed Management

Normal weeding treatment recorded significantly higher fallen leaf litter biomass production of various intercrops tried in cotton based systems over no weeding treatment during both years of experimentation. It might be due to reduced crop- weed competition by weeding treatment leads to increase growth of intercrops, thus produced more biomass. These results were in conformity of Yadav et al., (1998).

Effect of Fertility Management

Increased fertilizer levels of cotton had increased the leaf litter biomass production of intercrops. 125%, 100% and 75% being par with one another recorded significantly more or less equal production of leaf litter biomass in intercrops. Increased fertilizer levels of cotton might have helped to supply nutrients to intercrops also that resulted into production of more biomass. Similar type of findings was reported by Gaud and Kale (2010).

Effect of Interaction

Interaction effect was found significant. Treatment combination of cotton + pigeonpea (I3W2F3) recorded significantly higher leaf litter biomass production of pigeonpea over rest of treatments which was nearly followed by cotton+ marigold durig both t years of experimentation. The more production of fallen leaf litter biomass in pigeonpea and marigold might be due to longer duration and profused branching that produced more leaves and other plant parts that added to biomass weight.

Addition of Nitrogen, Phosphorous and Potassium through Fallen Leaf Litter Biomass of Intercrops

Effect of Intercropping

Intercropping of cotton + pigeonpea recorded significantly superior addition of nitrogen, phosphorous and potassium through leaf litter biomass of pigeonpea over rest of intercroppings. Second and third best position in recording more addition of nitrogen was showed by cotton + marigold and cotton + blackgram which was nearly followed by cotton + clusterbean and cotton + soybean intercropping. Cotton + blackgram nearly followed by cotton + cowpea and cotton + clusterbean recorded maximum phosphorous addition through leaf litter biomass. While, cotton + blackgram being par with cotton + clusterbean and cotton + cowpea recorded significantly equal and effective phosphorous addition over cotton + soybean. Whereas, cotton + soybean being par with cotton + clusterbean recorded significantly more potassium addition over cotton + cowpea. Intercropping of cotton + blackgram and cotton + clusterbean being par with one another showed significantly more potassium addition over cotton + soybean and cotton + cowpea through leaf litter biomass of different intercrops during 2007-08. During 2008-09, the trend of cotton + pigeonpea and cotton + marigold in recording significantly higher nitrogen, phosphorous and potassium addition was observed to be same. Increased nitrogen addition to soil might be due to inclusion of legumes as an intercrops that fixes aerial nitrogen, degenerate root nodules and absorption by plant at late stage. Similar results were corroborated by Giri et al., (2006).

Effect of Weed Management

Normal weeding recorded significantly higher addition of nitrogen, phosphorous and potassium through leaf litter biomass of various intercrops over no weeding treatment during both the years of experimentation. Weeding might have provided weed free condition created better environment for growth and development of crops which have produced more leaf litter biomass and thus added more nitrogen.

Effect of Fertility Management

Fertility levels of 125% RDF to base crop of cotton being par with 100% RDF recorded significantly maximum addition of nitrogen during both the years of study. Whereas, addition of phosphorous and potassium through leaf litter of intercrops during 2007-08. It

indicated that the increased dose of RDF increased nutrients addition to soil also through leaf litter biomass of intercrops. Similar observations were quoted by Shivran and Ahlawat, 2000.

Effect of interaction

Interaction effects were found significant. Treatment combination of cotton + pigeonpea (I3 W2 F1, I3 W2 F2, I3 W2 F3,) recorded significantly higher values for addition of nitrogen, phosphorous and potassium through leaf litter biomass of intercrops tried in cotton based systems over rest of treatment combinations during both the years of experimentation.

Conclusion

Based on results, it can be concluded that without fertilizers to intercrop of pigeonpea in cotton with normal weeding and fertilizers to cotton alone produced significantly higher fallen leaf litter biomass of pigeonpea and addition of more nutrients to the soil.

References

1. Anonymous (2007). Krisisamvadini, Published by Director of Extension Education Dr. PDKV, Akola. Pp. 46-271.
2. Giri, A. N., M. N. Deshmukh and S. B. G ore (2006). Nutrient management in monocrop cotton based cropping system. Indian J. Agron. 51:116-118.
3. Gaud, V. V. and H. B. Kale (2010). Productivity and profitability of pigeonpea under different sources of nutrients in rainfed condition of Central India. J. Food Legumes. 23 (3&4): 212-217.
4. Shivran, D. R. and IPS. Ahlawat, (2000). Crop productivity, nutrient uptake and soil fertility as influenced by cropping systems and fertilizers in pigeonpea – wheat cropping system. Ind. J. Agricultural Sci. 70: 815-819.
5. Yadav, R. P. and V. K. Srivastava (1998). Integrated weed management in blackgram. Indian J. Agron. 43 (1): 106-109.

Table1.

Fallen Leaf Litter Biomass Production of Intercrops and Addition of Nutrients to Soil During 2007-08 and 2008-09.

Treatments	Wt. of leaf litter biomass of intercrops (kg ha^{-1})		Addition of nutrients to soil through fallen leaf litter biomass of intercrops					
			2007-08 (kg ha^{-1})			2008-09 (kg ha^{-1})		
Main plots	2007-08	2008-09	Nitrogen	Phosphorous	Potassium	Nitrogen	Phosphorous	Potassium
A)Intercropping(6)								
I_1-Cotton+ blackgram	373.66	348.02	20.92	12.70	17.56	19.49	11.83	16.36
I_2-Cotton+ soybean	272.25	239.81	15.79	7.89	11.98	13.91	6.95	10.55
I_3-Cotton+pigeonpea	803.89	1150.56	43.41	25.72	32.96	62.13	36.82	47.17
I_4-Cotton+ clusterbea	318.52	396.66	18.16	9.24	11.78	22.61	11.50	14.68
I_5-Cotton+ cowpea	278.04	250.77	14.18	11.68	8.90	12.79	10.53	8.02
I_6-Cotton+ marigold	615.54	563.88	33.86	21.54	28.31	31.01	19.74	25.93
SEm ±	9.46	18.89	0.52	0.32	0.41	1.02	0.61	0.77
CD@5%	27.73	55.41	1.52	0.96	1.19	2.99	1.79	2.27
B)Weed management (2)								
W_1- No weeding	409.37	456.03	22.47	13.73	17.18	24.99	15.12	19.01
W_2-Normal weeding	477.93	527.20	26.30	15.87	19.98	28.99	17.33	21.89
SEm ±	5.46	10.91	0.30	0.19	0.23	0.59	0.35	0.45
CD@5%	16.01	31.99	0.88	0.55	0.69	1.73	1.03	1.31
Sub plot								
C)Fertility management (3)								
F_1-75%RDFto cotton	428.83	485.38	23.62	14.25	18.04	26.61	16.07	20.15
$F_2$100%RDFtocotton	441.88	491.70	24.26	14.77	18.46	26.99	16.25	20.45
F_3-125%RDFtocotton	460.25	497.77	25.27	15.17	19.25	27.38	16.37	20.77
SEm ±	7.51	8.45	0.41	0.26	0.33	0.46	0.28	0.34
CD@5%	21.37	NS	1.18	0.73	0.94	NS	NS	NS
Interactions(I×W×F)								
SEm ±	26.03	29.28	1.44	0.89	1.14	1.60	0.97	1.19
CD@5%	74.02	83.27	4.09	2.53	3.25	4.54	2.77	3.38
GM	443.65	491.62	24.39	14.80	18.58	26.99	16.23	20.45

Table 2. Interaction Effects of Intercropping × Weed × Fertilizer Management on Addition of Nitrogen, Phosphorous and Potassium Through them to Soil During 2007-08 and 2008-09.

	a) Addition of Nitrogen						b) Addition of Phosphorous						c) Addition of Potassium					
Treatcom	**2007-08**			**2008-09**			**2007-08**			**2008-09**			**2007-08**			**2008-09**		
IWF	**F_1**	**F_2**	**F_3**	**F_1**	**F_2**	**F_3**	**F_1**	**F_2**	**F_3**	**F_1**	**F_2**	**F_3**	**F_1**	**F_2**	**F_3**	**F_1**	**F_2**	**F_3**
I_1W_1	14.79	17.24	24.05	13.42	16.12	22.4	8.98	10.46	14.6	8.15	9.79	13.60	12.42	20.18	14.47	11.27	13.53	18.80
I_1W_2	19.60	22.51	27.37	18.68	19.72	26.6	11.9	13.67	16.6	11.34	11.97	16.14	16.44	18.89	22.97	15.68	11.55	22.32
I_2W_1	13.77	16.00	16.64	11.42	13.73	14.6	6.9	8.00	8.3	5.71	6.86	7.30	10.44	12.14	12.62	8.66	10.41	11.08
I_2W_2	14.50	16.74	17.09	11.53	15.47	16.7	7.25	8.37	8.5	5.76	8.36	7.73	11.00	12.70	12.96	8.75	11.73	12.68
I_3W_1	32.40	41.76	46.80	57.78	61.56	62.3	19.2	24.75	27.7	34.24	36.48	36.91	24.60	31.71	35.53	43.87	46.74	47.29
I_3W_2	44.10	45.90	49.50	59.04	61.92	70.2	26.1	27.20	29.3	34.99	36.70	41.60	33.48	34.85	37.58	44.83	47.01	53.30
I_4W_1	11.07	13.04	14.92	14.14	15.79	18.7	5.63	6.63	7.6	7.20	8.03	9.53	7.20	8.46	9.69	9.8	10.25	12.16
I_4W_2	22.37	23.37	24.15	28.13	28.76	30.1	11.9	12.32	13.1	14.31	14.63	15.31	14.52	15.17	15.68	18.26	18.67	19.53
I_5W_1	11.69	14.96	15.93	10.71	12.94	14.3	9.6	12.32	13.1	8.82	10.67	11.78	7.33	9.39	9.99	6.72	8.12	8.98
I_5W_2	12.70	14.28	15.53	12.31	13.07	13.4	10.5	11.76	12.8	10.14	10.76	11.04	7.97	8.96	9.74	7.72	8.20	8.41
I_6W_1	28.77	33.33	37.32	27.04	31.39	31.5	18.3	21.21	23.7	17.21	19.98	20.01	24.06	27.87	31.21	22.61	26.25	26.31
I_6W_2	30.83	36.07	36.83	28.93	33.36	33.9	19.6	23.0	23.4	18.41	21.23	21.58	25.78	30.16	30.80	24.20	27.90	28.36
SE m±	1.44			1.60			0.89			0.97			1.14			1.19		
CD@5%	4.09			4.45			2.53			2.77			3.25			3.38		

Table 3. Interaction Effects of Intercropping × Weed × Fertilizer Management on Fallen Leaf Litter Biomass Production of Intercrops (Kg Ha^{-1}) During 2007-08 and 2008-09.

Treats	**2007-08**			**2008-09**		
I×W×F	**F_1**	**F_2**	**F_3**	**F_1**	**F_2**	**F_3**
I_1W_1	264.2	307.8	429.4	239.7	287.9	399.9
I_1W_2	349.9	401.9	488.7	333.7	352.1	474.8
I_2W_1	237.4	276.0	289.0	196.9	236.7	251.7
I_2W_2	250.0	288.6	294.6	198.8	266.6	288.2
I_3W_1	600.0	773.3	866.7	1070.0	1140.0	1153.3
I_3W_2	850.5	816.7	916.7	1090.0	1146.7	1300.0
I_4W_1	194.3	228.8	261.8	248.1	277.0	328.8
I_4W_2	392.5	410.0	423.7	493.6	504.5	527.9
I_5W_1	229.1	293.3	312.3	210.0	253.7	280.5
I_5W_2	249.0	280.0	304.5	241.3	256.2	262.7
I_6W_1	523.0	606.0	678.5	491.6	570.7	571.9
I_6W_2	560.5	655.8	669.6	526.0	606.6	616.5
Em±	26.03			29.28		
CD@5%	74.02			83.27		