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Evaluation of leguminous cover crop and banana bio-mat mulching for weed suppression and conservation of soil moisture and nutrient in guava orchard

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ABSTRACT

An experiment was carried out to evaluate the effect of cover crop and banana bio-mat mulching on weed suppression and moisture and nutrient conservation in guava orchard during 2016-17 at ICAR-AICRP on Fruits, BCKV. All mulching treatments were found effective for suppression of weed and conservation of moisture and nutrient, compared with unmulched control. Black polythene mulching recorded maximum weed control efficiency (WCE: 67.96%), soil moisture (21.90%) and temperature (25.30^0 C), however, it was non-biodegradable in nature. Among organic mulches, cover crop + banana bio-mat (webbed leaf sheath) mulching recorded the maximum WCE (61.49%), leaf nutrient content (NPK) and soil P_2O_5 (41.53 kg ha^{-1}) after harvest. The maximum organic carbon (0.92%) and available N (242.10 kg ha^{-1}) content of soil were recorded due to cover crop + chopped leaf of banana mulching, while the maximum soil K_2O (234.58 kg ha^{-1}) content was recorded under cover crop + banana bio-mat (webbed leaf) mulching. Application of cover crop and banana bio-mat mulch was therefore, suggested for eco-friendly and cost effective management of weeds and sustainable conservation of moisture and nutrients of soil in guava orchard grown in the Gangetic Alluvium region of West Bengal.

***Keywords*:** Banana bio-mat mulch, guava, leguminous cover crop, nutrient, soil moisture and weed management

Guava (*Psidium guajava*) also known as apple of tropics is the fourth most important fruit crop in India due to its nutritional value and acceptance by the people. The farmers of guava growing region of West Bengal have to face two most important issues of guava orchard floor management, *viz*., suppression of excessive weed growth during rainy season and soil moisture conservation during dry period which directly affect the growth and yield of guava plant and profit of the farmers. The conventional practices of using plastic mulch or applying herbicides for weed control are not environmentally friendly, owing to the possible negative impact of herbicides and non-degradable plastic on soil and environment (Kasirajan and Ngouajio, 2012). In contrast, application of organic materials in the form of mulching are considered much important for sustainability of orchard productivity, conservation nutrients and maintenance of soil health (Mahata *et al*., 2008 and Ghorai, 2004). Another eco-friendly biological tool is the leguminous cover crop which acts as a living cover on the orchard floor, suppress the weed growth as well as fix the atmospheric nitrogen to the soil (Jayasinghe, 2008). The huge unutilized biomass of banana plantation appeared to be a cheap source of organic materials for mulching, because it was estimated that out of the total biomass produced by a banana plant (cv. Martaman, Musa AAB), only 15-20% constitute the fruits and marketed immediately but rest biomass (80-85%) including pseudostem, leaf, rhizome *etc*. was a neglected waste and not used properly. The unutilized biomass was estimated to be about 150 tonnes ha^{-1} (Debnath *et al*., 2010). With above background, the present experiment was conducted to study the effect of unutilized biomass of banana plantation as organic mulching material and leguminous cover crop (LCC) on suppression of weed growth and conservation of soil moisture and nutrient in guava orchard.

MATERIALS AND METHODS

The experiment was carried out at ICAR-AICRP on Fruits, Bidhan Chandra Krishi Viswavidyalaya, Mondouri, Nadia, West Bengal, during the year 2016-17. The experimental area belongs to the hot humid region of Assam and Bengal Plains (as per NBSSLUP). The site is situated at 9.75 m above mean sea level, latitude 22^{0}56′10.90″ N and longitude 88^{0}30′31.55″E. The soil under the experiment was clay loam in texture (Sand-55.40%, Silt-23.00%, Clay- 21.60%), field capacity (% v/v)- 26.37, soil pH-7.10, organic carbon-0.65%, available nitrogen–156.49 kg ha^{-1}, available P_2O_5 – 35.7 kg ha^{-1}, available K_2O–172.40 kg ha^{-1}, Ca–36.4 µg g^{-1}, Mg–40.2 µg g^{-1}, Zn–16.73 µg g^{-1}.

The experiment with eleven treatments including control were imposed twice, *i.e*., on 25th January, 2017 and 12th May, 2017. All the treatments were imposed using waste biomass of banana (WBB), leguminous

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cover crop (LCC) and black polythene (BP) as mulching materials. The treatments were mulching with banana bio-mat (webbed leaf-WL) [T_1], banana bio-mat (webbed leaf sheath-WLS) [T_2], Chopped leaf of banana (CL) [T_3], Chopped leaf sheath of banana (CLS) [T_4], Cover crop (CC) [T_5], CC + WL [T_6], CC + WLS [T_7], CC + CL [T_8], CC + CLS [T_9], Black polythene [T_{10}] and no mulching and no cover crop [T_{11}]. The uniform guava plants cv. Sardar (L-49) of 3 years old aged, planted at square system (3 x 3m) under high density planting (1111 ha^{-1}) were chosen for the experiment. Before treatment impose i.e. 2nd week of January, 2017, the soil was cultivated followed by recommended dose of fertilizer and irrigation was applied. The water soaked seeds of leguminous cover crop @ 27 g per 9 m^2 of ground area of each experimental plant was as per the treatment. In winter season black gram cv. Kalindi while in summer season mung bean cv. Samrat was sown. The banana biomass was collected from harvested banana plants and banana bio-mat (BBM) was prepared by webbing the leaf and leaf sheath of banana. The chopped leaf and chopped leaf sheath was also prepared by using sickle. The prepared materials were applied @ 30 kg per 9 m^2 of ground area of each plant as per treatment was done. In next season, again the treatments were imposed as before, as per the layout. The data obtained from the experiment were analyzed statistically by the analysis of variance method for Randomized Block Design (RBD), as suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Weed suppression and weed index

All the mulching treatments significantly suppressed weeds by decreasing the fresh and dry weight of weed and increased weed control efficiency (WCE), compared with unmulched control. Maximum fresh and dry weight of weed (909.20 g m^{-2} in ambe bahar and 108.66 g m^{-2} in mrig bahar) were recorded from the unmulched control (T_{11}), whereas it was minimum (254.40 g m^{-2} in ambe bahar and 34.91 g m^{-2} in mrig bahar) under black polythene mulching (T_{10}), followed by 273.60 g m^{-2} and 42.01 g m^{-2} in ambe and mrig bahar respectively due to the treatment with cover crop + banana bio-mat (webbed leaf sheath) mulch (T_7) [Table 1]. The weed control efficiency (WCE) and weed index (WI) was calculated and it was recorded that the black polythene mulching (T_{10}) recorded maximum (67.96%) WCE followed by 61.49% WCE in combine application of cover crop and banana bio-mat (webbed leaf sheath) mulching (T_7). Whereas, the highest (25.71%) WI was estimated from unmulched control (T_{11}) and minimum (2.28%) WI was recorded from the mulching treatment with cover crop and banana bio-mat (webbed leaf sheath) mulching (T_7) [Table 2]. The investigations conducted by Matos *et al*. (2009) and Borthakur and Bhattacharyya (1993) in guava, Reddy and Khan (2000) in sapota and Mangara and Adopo (2013) in pineapple also revealed that application of mulching treatments effectively suppressed the weed growth and weed population in respective fruit orchards.

Weed species

Ten species of different weeds were recorded in ambe bahar, *viz*., *Acalypha indica*, *Cassia occidentalis*, *Digitaria sanguinalis*, *Cynodon dactylon*, *Euphorbia hirta*, *Echinochloa colona*, *Mimosa pudica*, *Stephania japonica*, *Leersia hexandra*. Eleven species of different weeds were recorded in mrig bahar, viz. *Solanum khasianum*, *Physalis minima*, *Portulaca oleracea*, *Cleome viscosa*, *Digitaria sanguinalis*, *Ageratum houstonianum*, *Cynodon dactylon*, *Echinochloa colona*, *Chenopodium album*, *Leersia hexandra*, *Amaranthus viridis*.

Leaf nutrient content at flowering stage

The mulching treatments also significantly improved the leaf nutrient content of guava. The plants under combination treatment with cover crop and banana bio-mat (webbed leaf sheath) (T_7) recorded the maximum N, P and K content of leaf in both the bahar (1.75%, 0.54% and 1.68% NPK respectively in ambe bahar and 1.85%, 0.52% and 1.71% NPK respectively in mrig bahar), followed by 1.72%, 0.53% and 1.67% NPK respectively in ambe bahar and 1.84%, 0.50% and 1.70% NPK respectively in mrig bahar in the plants under black polythene mulching (T_{10}). But it was minimum (1.56%, 0.44%, 1.58% NPK respectively in ambe bahar and 1.72%, 0.40% and 1.60% NPK respectively in mrig bahar) in the plants under unmulched control (T_{11}) [Table 3]. Earlier Borthakur and Bhattacharyya (1999) also recorded the highest leaf N, P and K content of guava having mulching treatment with organic material and the lowest values of N, P and K content of leaf was recorded in unmulched control.

Soil moisture and temperature

The average soil moisture content during the experimental period was recorded and it was found to be highest (21.90%) under black polythene mulching treatment (T_{10}) followed by 21.68% in banana bio-mat (webbed leaf sheath) mulching (T_2). But it was lowest (18.02%) under the unmulched control (T_{11}) [table 4]. Similar effect of mulching on soil moisture conservation was also recorded earlier by Madhu *et al*. (2001), Bakshi *et al*. (2015), Abolfazl (2016) and Swamy *et al*. (1998). The average soil temperature during experimental period was recorded maximum (25.30^{0}C) under mulching with

Table 1: Effect of organic mulching (WBB) and leguminous cover crop (LCC) on fresh weight and dry weight of weed in guava orchard cv. Sardar (L-49)

Treatments	Fresh weight of weed** ($g\ m^{-2}$)			Dry weight of weed ($g\ m^{-2}$)		
	Ambe (April, 2017)	Mrig (July, 2017)	Total	Ambe (April, 2017)	Mrig (July, 2017)	Total
T_1- Mulching with banana bio-mat (webbed leaf-WL)	222.40	266.40	488.80	31.87	37.26	69.13
T_2- Mulching with banana bio-mat (webbed leaf sheath-WLS)	176.00	214.80	390.80	24.05	29.35	53.39
T_3- Mulching with chopped leaf of banana (CL)	240.80	281.60	522.40	38.07	43.99	82.06
T_4- Mulching with chopped leaf sheath of banana (CLS)	193.20	233.60	426.80	28.39	34.47	62.86
T_5- Cover crop (CC)	210.40	246.00	456.40	29.63	34.64	64.27
T_6- CC + WL	162.00	177.20	339.20	21.45	26.25	47.70
T_7- CC + WLS	132.80	140.80	273.60	18.33	23.68	42.01
T_8- CC + CL	164.80	190.40	355.20	22.50	27.58	50.08
T_9- CC + CLS	141.60	162.00	303.60	19.42	25.32	44.74
T_{10}- Mulching with black polythene (BP)	126.00	128.40	254.40	15.57	19.34	34.91
T_{11}- No mulching and no cover crop (Control)	422.00	487.20	909.20	50.43	58.23	108.66
SEm (±)	**4.32**	**3.08**	**-**	**0.62**	**0.71**	**-**
LSD (0.05)	**8.06**	**7.74**	**-**	**2.05**	**2.09**	**-**

Table 2: Effect of organic mulching (WBB) and leguminous cover crop (LCC) on weed control efficiency (WCE) and weed index (WI) in guava orchard cv. Sardar (L-49)

Treatments	Weed Control Efficiency (WCE %)			Weed Index (WI %)		
	Ambe (April, 2017)	Mrig (July, 2017)	Average	Ambe (April, 2017)	Mrig (July, 2017)	Average
T_1- Mulching with banana bio-mat (webbed leaf-WL)	36.80 (37.76)	36.01 (37.17)	36.41	9.93(3.15)	21.10(4.59)	15.51
T_2- Mulching with banana bio-mat (webbed leaf sheath-WLS)	52.32 (46.43)	49.60 (45.29)	50.96	9.68(3.11)	15.72(3.96)	12.70
T_3- Mulching with chopped leaf of banana (CL)	24.51 (30.33)	24.45 (29.67)	24.48	14.93(3.86)	25.21(5.02)	20.07
T_4- Mulching with chopped leaf sheath of banana (CLS)	43.70 (41.84)	40.80 (40.11)	42.25	14.75(3.84)	23.36(4.83)	19.05
T_5- Cover crop (CC)	41.24 (40.11)	40.51 (40.11)	40.87	7.76(2.79)	14.78(3.84)	11.27
T_6- CC + WL	57.47 (49.31)	54.92 (48.16)	56.19	2.97(1.72)	3.05(1.75)	3.01
T_7- CC + WLS	63.65 (53.43)	59.34 (50.48)	61.49	1.61(1.27)	2.95(1.71)	2.28
T_8- CC + CL	55.38 (48.16)	52.64 (47.01)	54.01	6.63(2.57)	12.14(3.48)	9.39
T_9- CC + CLS	61.49 (51.65)	56.52 (49.31)	59.00	5.93(2.44)	8.28(2.88)	7.10
T_{10}- Mulching with black polythene (BP)	69.13 (56.48)	66.79 (55.24)	67.96	0.00(0.00)	0.00(0.00)	0.00
T_{11}- No mulching and no cover crop (Control)	0.00 (1.28)	0.00 (1.28)	-	20.45(4.52)	29.96(5.47)	25.71
SEm (±)	**0.85**	**0.78**	**-**	**0.14**	**0.11**	**-**
LSD (0.05)	**1.71**	**1.34**	**-**	**0.29**	**0.25**	**-**

Table 3: Effect of organic mulching (WBB) and leguminous cover crop (LCC) on leaf nutrient content at flowering stage of guava orchard cv. Sardar (L-49)

Treatments*	Leaf nutrient content (%)					
	Ambe (April, 2017)			Mrig (July, 2017)		
	N	P	K	N	P	K
T_1- Mulching with banana bio-mat (webbed leaf-WL)	1.61 (1.27)	0.47 (0.69)	1.61 (1.27)	1.77 (1.33)	0.44 (0.66)	1.63 (1.28)
T_2- Mulching with banana bio-mat (webbed leaf sheath-WLS)	1.62 (1.27)	0.48 (0.69)	1.62 (1.27)	1.79 (1.34)	0.45 (0.67)	1.63 (1.28)
T_3- Mulching with chopped leaf of banana (CL)	1.59 (1.26)	0.46 (0.68)	1.60 (1.26)	1.74 (1.32)	0.42 (0.65)	1.61 (1.27)
T_4- Mulching with chopped leaf sheath of banana (CLS)	1.59 (1.26)	0.46 (0.68)	1.60 (1.26)	1.76 (1.33)	0.42 (0.65)	1.61 (1.27)
T_5- Cover crop (CC)	1.66 (1.29)	0.49 (0.70)	1.63 (1.28)	1.80 (1.34)	0.46 (0.68)	1.65 (1.28)
T_6- CC + WL	1.70 (1.30)	0.51 (0.71)	1.65 (1.28)	1.83 (1.35)	0.49 (0.70)	1.69 (1.30)
T_7- CC + WLS	1.75 (1.32)	0.54 (0.73)	1.68 (1.30)	1.85 (1.36)	0.52 (0.72)	1.71 (1.31)
T_8- CC + CL	1.69 (1.30)	0.50 (0.71)	1.64 (1.28)	1.82 (1.35)	0.48 (0.69)	1.67 (1.29)
T_9- CC + CLS	1.69 (1.30)	0.50 (0.71)	1.65 (1.28)	1.82 (1.35)	0.48 (0.69)	1.68 (1.30)
T_{10}- Mulching with black polythene (BP)	1.72 (1.31)	0.53 (0.73)	1.67 (1.29)	1.84 (1.36)	0.50 (0.71)	1.70 (1.30)
T_{11}- No mulching and no cover crop (Control)	1.56 (1.25)	0.44 (0.66)	1.58 (1.26)	1.72 (1.31)	0.40 (0.63)	1.60 (1.26)
SEm (±)	**0.005**	**0.003**	**0.006**	**0.003**	**0.005**	**0.003**
LSD (0.05)	**0.010**	**0.009**	**0.013**	**0.009**	**0.010**	**0.009**

Table 4: Effect of organic mulching (WBB) and leguminous cover crop (LCC) on soil moisture content of guava orchard cv. Sardar (L-49)

Treatments	Soil moisture content of available moisture at field capacity				
	January, 2017	February, 2017	March, 2017	April, 2017	May, 2017
T_1- Mulching with banana bio-mat (webbed leaf-WL)	14.90	18.43	22.07	21.85	21.19
T_2- Mulching with banana bio-mat (webbed leaf sheath-WLS)	15.23	19.63	22.22	22.00	21.34
T_3- Mulching with chopped leaf of banana (CL)	14.28	18.02	21.20	20.99	20.36
T_4- Mulching with chopped leaf sheath of banana (CLS)	14.64	18.26	21.65	21.43	20.79
T_5- Cover crop (CC)	13.21	16.19	19.59	19.39	18.81
T_6- CC + WL	13.71	17.43	20.65	20.44	19.83
T_7- CC + WLS	13.98	17.68	20.91	20.70	20.08
T_8- CC + CL	13.35	17.05	20.17	19.97	19.37
T_9- CC + CLS	13.52	17.13	20.33	20.13	19.52
T_{10}- Mulching with black polythene (BP)	15.29	20.24	22.41	22.19	21.52
T_{11}- No mulching and no cover crop (Control)	12.64	15.72	18.54	18.35	17.80
SEm (±)	**0.22**	**0.44**	**0.70**	**0.57**	**0.18**
LSD (0.05)	**0.67**	**1.31**	**1.06**	**1.69**	**0.55**

Contd.

Contd. Table 4

Treatments	Soil moisture content of available moisture at field capacity					Average
	June, 2017	July, 2017	Aug., 2017	Sept., 2017	Oct., 2017	
T_1- Mulching with banana bio-mat (webbed leaf-WL)	23.17	23.64	24.11	22.48	22.25	21.40
T_2- Mulching with banana bio-mat (webbed leaf sheath-WLS)	23.33	23.80	24.27	22.63	22.40	21.68
T_3- Mulching with chopped leaf of banana (CL)	22.26	22.71	23.16	21.59	21.38	20.59
T_4- Mulching with chopped leaf sheath of banana (CLS)	22.73	23.19	23.65	22.05	21.83	21.02
T_5- Cover crop (CC)	20.57	20.98	21.40	19.95	19.75	18.98
T_6- CC + WL	21.68	22.12	22.56	21.03	20.82	20.02
T_7- CC + WLS	21.96	22.39	22.84	21.30	21.08	20.29
T_8- CC + CL	21.18	21.60	22.03	20.54	20.34	19.56
T_9- CC + CLS	21.35	21.77	22.21	20.71	20.50	19.71
T_{10}- Mulching with black polythene (BP)	23.53	24.00	24.48	22.82	22.60	21.90
T_{11}- No mulching and no cover crop (Control)	19.47	19.86	20.25	18.88	18.69	18.02
SEm (±)	**0.15**	**0.23**	**0.12**	**0.15**	**0.12**	**-**
LSD (0.05)	**0.45**	**0.70**	**0.37**	**0.44**	**0.37**	**-**

Table 5: Effect of organic mulching (WBB) and leguminous cover crop (LCC) on soil temperature guava orchard cv. Sardar (L-49)

Treatments	Soil temperature (^{0} C)				
	January, 2017	February, 2017	March, 2017	April, 2017	May, 2017
T_1- Mulching with banana bio-mat (webbed leaf-WL)	19.75	20.74	22.60	24.64	26.61
T_2- Mulching with banana bio-mat (webbed leaf sheath-WLS)	19.36	20.33	22.16	24.15	26.08
T_3- Mulching with chopped leaf of banana (CL)	19.83	20.82	22.70	24.74	26.72
T_4- Mulching with chopped leaf sheath of banana (CLS)	20.25	21.26	23.18	25.26	27.28
T_5- Cover crop (CC)	17.92	18.82	20.51	22.36	24.14
T_6- CC + WL	18.35	19.27	21.00	22.89	24.72
T_7- CC + WLS	18.31	19.23	20.96	22.84	24.67
T_8- CC + CL	18.51	19.44	21.18	23.09	24.94
T_9- CC + CLS	18.82	19.76	21.54	23.48	25.36
T_{10}- Mulching with black polythene (BP)	20.45	21.47	23.41	25.51	27.55
T_{11}- No mulching and no cover crop (Control)	17.44	18.31	19.96	21.76	23.50
SEm (±)	**0.11**	**0.19**	**0.27**	**0.11**	**0.13**
LSD (0.05)	**0.33**	**0.56**	**0.79**	**0.33**	**0.38**

Contd.

Contd. Table 5

Treatments	Soil temperature (^{0}C)					Average
	June, 2017	July, 2017	Aug., 2017	Sept., 2017	Oct., 2017	
T_1- Mulching with banana bio-mat (webbed leaf-WL)	27.41	26.31	26.57	25.51	24.24	24.44
T_2- Mulching with banana bio-mat (webbed leaf sheath-WLS)	26.87	25.79	26.05	25.01	23.76	23.96
T_3- Mulching with chopped leaf of banana (CL)	27.52	26.42	26.68	25.61	24.33	24.54
T_4- Mulching with chopped leaf sheath of banana (CLS)	28.10	26.98	27.25	26.16	24.85	25.06
T_5- Cover crop (CC)	24.87	23.87	24.11	23.15	21.99	22.17
T_6- CC + WL	25.46	24.45	24.69	23.70	22.52	22.71
T_7- CC + WLS	25.41	24.39	24.64	23.65	22.47	22.66
T_8- CC + CL	25.69	24.66	24.91	23.91	22.71	22.90
T_9- CC + CLS	26.12	25.07	25.32	24.31	23.09	23.29
T_{10}- Mulching with black polythene (BP)	28.38	27.24	27.52	26.42	25.09	25.30
T_{11}- No mulching and no cover crop (Control)	24.20	23.23	23.47	22.53	21.40	21.58
SEm (±)	**0.08**	**0.14**	**0.08**	**0.13**	**0.10**	**-**
LSD (0.05)	**0.23**	**0.42**	**0.24**	**0.37**	**0.30**	**-**

Table 6: Soil nutrient status after harvest of fruits from orchard of guava orchard cv. Sardar (L-49) under different treatments

Treatment	Soil nutrient status*				
	Soil pH	Organic C (%)	N (kg ha^{-1})	P_2O_5 (kg ha^{-1})	K_2O (kg ha^{-1})
T_1- Mulching with banana bio-mat (webbed leaf-WL)	6.70	0.72	197.50	34.37	197.50
T_2- Mulching with banana bio-mat (webbed leaf sheath-WLS)	6.80	0.76	212.60	35.77	193.43
T_3- Mulching with chopped leaf of banana (CL)	6.90	0.85	195.40	33.99	215.02
T_4- Mulching with chopped leaf sheath of banana (CLS)	6.95	0.83	207.24	37.38	204.40
T_5- Cover crop (CC)	7.20	0.73	226.40	30.23	158.46
T_6- CC + WL	7.10	0.77	235.60	37.19	234.58
T_7- CC + WLS	7.15	0.81	232.30	41.53	204.63
T_8- CC + CL	7.10	0.92	242.10	40.37	195.37
T_9- CC + CLS	7.00	0.88	229.50	38.08	196.70
T_{10}- Mulching with black polythene (BP)	7.35	0.62	188.80	24.18	166.90
T_{11}- No mulching and no cover crop (Control)	7.20	0.68	165.30	26.80	168.70
SEm (±)	**0.01**	**0.00**	**0.97**	**0.62**	**0.66**
LSD (0.05)	**0.02**	**0.01**	**2.87**	**1.82**	**1.95**

*Note: * Nutrient content of organic mulching (biomass of banana): N- 0.21%, P_2O_5- 0.02%, K_2O-0.52%*

black polythene (T_{10}) followed by 25.06^0 C in mulching with chopped leaf sheath of banana (T_4) whereas it was recorded minimum (21.58^0 C) under unmulched control (T_{11}). All the mulching treatments significantly increased the soil temperature compared with unmulched control (T_{11}) [table 5]. Eruola *et al*. (2012) and Richardson *et al*. (1993) also recorded from their investigation that the mulching treatments improved the soil temperature and reduced the temperature fluctuation in soil in the orchard of guava and Satsuma mandarin, respectively.

Soil nutrient status after harvest of fruit

The soil nutrient status after harvesting of fruits was also analyzed and it was found that the different mulching treatments significantly improved the organic carbon, N, P_2O_5 and K_2O content in soil after harvest of fruit. However, the maximum N (242.10 kg ha^{-1}) content of soil were recorded under the cover crop + chopped leaf of banana mulch (T_8) treatment, while the maximum P_2O_5 (41.53 kg ha^{-1}) content of soil was recorded due to cover crop + banana bio-mat (webbed leaf sheath) mulch (T_7). The K_2O content of soil was maximum (234.58 kg ha^{-1}) under the cover crop + banana bio-mat (webbed leaf) mulch (T_6) treatment. The treatment with cover crop + chopped leaf mulching (T_8) showed maximum organic carbon (0.92%) content in the soil but the black polythene mulch treatment (T_{10}) recorded the minimum content of organic carbon (0.62%) and P_2O_5 (24.18 kg ha^{-1}) in the soil, while the soil N content was minimum (165.30 kg ha^{-1}) in unmulched control (T_{11}). The K_2O content of soil was recorded minimum (158.46 kg ha^{-1}) due to treatment with sole cover crop grown treatment (T_5). The pH of soil after harvest was recorded to vary significantly from 6.70 to 7.35 due to different treatments, compared with the initial value of 7.10. The decline in pH value was recorded by T_1, T_2, T_3, T_4 and T_9 treatments, while it was recorded unchanged due to T_6 and T_8 treatments. The increase in pH value was recorded due to T_5, T_7 and T_{10} and T_{11} treatments [table 6]. The research findings of Oliveira *et al*. (2015), Jayasinghe (2008), Haripriya and Poonkod (2005), Lehmann *et al*. (2000) and Carter (1997) also showed that the organic mulching and leguminous cover crop had improved the soil nutrient status and availability of nutrients to the plants. It appeared that the organic matter of organic mulch materials after its decomposition, added organic carbon and nutrients to the soil, while the leguminous cover crops added nitrogen to the soil through fixation of atmospheric nitrogen to the soil.

It was revealed from the present study that all the mulching treatments significantly suppressed weed growth, increased the leaf nutrient content and improved the soil nutrient status as well as moisture content of orchard soil. Black polythene mulching resulted in maximum weed control efficiency, soil moisture and soil temperature which was statistically at par with cover crop + banana bio-mat (webbed leaf sheath) mulching. Cover crop + banana bio-mat (webbed leaf sheath) mulching also resulted in maximum leaf nutrient content of plant and improved soil nutrient status after harvesting of fruits. So, from the present study, combined application of cover crop and banana bio-mat mulch was suggested for eco-friendly and cost effective management of weeds and sustainable conservation of moisture and nutrients of soil in guava orchard grown in the Gangetic Alluvium region of West Bengal.

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