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Effect of Tillage and Conservation Farming on Weed Population and Yield of Finger Millet (*Eleusine coracana* L.) under Rainfed Ecosystem

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A B S T R A C T

Field experiment was conducted during the *Kharif* seasons of 2016 at Instructional cum Research Farm, S.G. College of Agriculture and research station, Jagdalpur (C.G.). The treatment consisted of three tillage practices *viz.* T1- Conventional tillage, T2 –Minimum tillage and T_3 – Summer plouging and five conservation farming *viz.* C1-Opening conservation, C2-Intercropping with redgram, C3-Mulching, C4-Herbicide application, C5-Combination of all treatments (C_1+C_2+C_3+C_4). Observations of crops are analyzed in Split plot design having three replications. The result revealed that Weed population, density and dry weight observed significantly heights in conventional and minimum tillage. Whereas, highest grain yield ha^{-1}, test weight and stover yield but harvest index was recorded significantly highest in minimum tillage. In case of conservation farming system Weed population, density and dry weight observed significantly heights in opening conservation and redgram intercropping practices. Whereas highest grain yield ha^{-1}, test weight and stover yield but harvest index was recorded significantly highest in intercropping with redgram during experimentation.

Introduction

Finger millet (*Eleusine coracana* G.) crop is generally grown in the Bastar zone of Chhattisgarh on the moderate hill slopes and uplands which are less fertile and productive where rice cultivation is not possible. To get higher yield of quality finger millet, new high yielding fertilizer responsive varieties should be adapted with proper nutrient management practices. The productivity is low due to late transplanting, faulty methods of cultivation and little or no use of fertilizers. The secret of boosting its yields mainly lies in suitable planting method and properly fertilizing the crop (Ahiwale *et al.*, 2013). Millets are important staple foods in semi-arid tropics of Asia and Africa. Low productivity and susceptibility to biotic and abiotic factors are the major reasons for declining area and productivity of millets in India. As the millets are grown predominantly in the hot and humid rainy season, weeds deprive these crops of vital nutrients and moisture and reduce the yield considerably (Mishra, 2015). The role of tillage in conserving soil moisture and its subsequent beneficial effect on crop productivity has long been recognized Adequate tillage operations controlled weeds and resulted in higher crop productivity, but caused more soil loss and were more capital intensive (Dogra *et al.*, 2002). Different tillage practices significantly influenced weed population. Irrespective of the weed species, conventional tillage significantly reduced the population of weeds compared to reduced tillage and minimum tillage. The inversion of soil by following conventional tillage resulted in deeper placement of weed seeds which could not emerge out, causing a significant reduction in the population of weeds (Vijaymahantesh *et al.*, 2013). Population density, and distributions in cereal fields vary from place to place depending upon soil and climatic factors and management practices (Abraham, 2008).

Annual weeds dominated the trial. Generally, across the treatment grassy weeds dominated the weed flora while broad leaved weeds were the least occurring in the trial. Rezene (2001) also indicated that species of poacea are the most common in small grains including finger millet. Weed control during early stages of crop growth period was found important as revealed from the significant decrease in yield due to delay in weeding from 15-65 days period after seeding (Ghosh, 2000). Initial growth period of finger millet is subjected to infestation of weeds causing higher competition, leading to drastic reduction in yield (Kushwaha *et al.*, 2002).

Materials and Methods

The field experiment was carried out during *kharif* session of 2016 at Instructional cum Research Farm, S.G. College of Agriculture and research station, Jagdalpur (C.G.). Chhattisgarh is situated in between 19^0 05’36.55” North latitude and $81^0$57’34.69” East longitude with altitude ranging from 550-760m above mean sea level. During *khairf* 2016 a total of 1740.2 mm rainfall was received in 78 rainy days. There was no rainfall recorded at the end of the crop season. The maximum temperature varied from 31.7^{o}C in fourth week of June to 30.7^{o}C in fourth week of November, whereas, minimum temperature varies from 13.8^{o}C in first week of November to 13.1^{o}C in second week of December. The soil of the experimental field was sandy clay loam having a pH 6.2, with 0.05% organic carbon, available nitrogen 220 kg ha^{-1}, phosphorus 12.99 kg ha^{-1}and potassium 256.01 kg ha^{-1}.The experiment in *Kharif* season was framed in split plot design with three replications. The main plot treatment consisted of three tillage practices *viz.* conventional tillage (T_1), minimum tillage (T_2) and summer ploughing (T_3) and five conservation farming *viz.* opening conservation furrow (C_1), intercropping of finger millet + red gram (C_2), mulching with crop residues (C_3), weedicide application (Pre emergence): Isoproturon @ 0.5 kg *a.i.* ha^{-1} (C_4) and C_1+C_2+C_3+C_4 (C_5).

Results and Discussion

Population of *Cyperus iria* (m^{-2})

Data presented in Table 1 reveals that population of *Cyperus iria* was recorded significantly highest in T_1 (Conventional tillage) at 15 and 30 DAS which was on par with treatment T_2 (minimum tillage) remaining observation were recorded unaffected due to tillage. It might be due to tillage inverse the seed and rhizome. *Cyperus iria* population was significantly affected by different conservation farming.

Treatment C_1 (Open conservation) recorded significantly higher population of *Cyperus iria* at different observation period which was on par with treatment C_2 (Intercropping with redgram) at 30 DAS, 60 and 90 DAS but treatment C_2 (Intercropping with redgram) recorded highest population at 45 DAS and at harvest which was at par with C_1 (Opening conservation). It was due to the both opening conservation and intercropping allows the germination of *Cyperus iria* than the mulch and herbicide application plot. Covering of the soil with a thick layer of mulch, deprive weed seeds from sunlight necessary for germination, photosynthesis and growth (Rao, 2002).

Population of *Cyperus rotundus* (m^{-2})

The data on population *Cyperus rotundus* as influenced of different tillage and conservation farming are given in Table 2 at 30 and 90 DAS treatment T_2 (Minimum tillage) recorded higher population of *Cyperus rotundus* which was at par with T_1 (Conventional tillage) at 30 DAS remaining observation period was found unaffected due to tillage method.

In case of conservation farming treatment, C_2 (Intercropping with redgram) produce significantly higher population of *Cyperus rotundus* at 15, 45, 60, 90 DAS and at harvest which was on par with C_1 (Opening conservation) except at 30 DAS, treatment C_1 (Opening conservation) recorded higher population which was at par with treatment C_2 (Intercropping with redgram) at 30 DAS. Adequate tillage operations controlled weeds and resulted in higher crop productivity, but caused more soil loss and were more capital intensive (Dogra *et al.,* 2002).

Population of *Echinochloa colona* (m^{-2})

Data on population of *Echinochloa colona* on finger millet field as influenced by different tillage and conservation farming are presented in Table 3 at 30 DAS and at harvest treatment T_1 (Conservation tillage) recorded higher population of *Echinochloa colona* which was at par with treatment T_2 (Minimum tillage) but at 45 DAS treatment T_1 (Conventional tillage) produce higher population which was at par with treatment T_2 (Minimum tillage). In case of conservation farming, treatment C_1 (Opening conservation) produce higher weed population (*Echinochloa colona)* at all the observation period except at 60 DAS but it was at par with C_2 (Intercropping with redgram) at 45, 90 DAS and at harvest.

Whereas, treatment C_2 (Intercropping with redgram) recorded highest population of *Echinochloa colona* at 60 DAS. Gowda *et al.,* (2012) reported lowest yield was observed in unweeded control with 1425 kg^{-1}ha grain and 2104 kg^{-1} ha of straw yield, due to higher weed competition and higher weed biomass growth.

Population of *Fimbristylis miliacea* (m^{-2})

Population of *Fimbristylis miliacea* as influenced by different tillage and conservation farming are given in Table 4, in finger millet field population of *Fimbristylis miliacea* showed significantly highest in treatment T_1 (Conventional tillage) at 45 and 90 DAS at 15 and 30 DAS treatment T_2 (Minimum tillage) recorded higher population which was at par with T_1 (Conventional tillage) at 15 DAS. At 60 DAS and at harvest population of *Fimbristylis miliacea* recorded non-significant effect due to tillage.

In conservation farmings, treatment C_1 (Opening conservation) recorded significantly higher population of *Fimbristylis miliacea* at 15, 45 and 90 DAS which was at par with treatment C_2 (Intercropping with redgram) but treatment C_2 (Intercropping with redgram) produce higher population at 30, 60 and at harvest which was on par with C_1 (Opening conservation). Guruprasanna *et al.,* (2004) observed that chlorimuron ethyl at 5 and 10 g ha^{-1} recorded grain yield of finger millet on par with hand weeding twice and isoproturon.

Gowda *et al.,* (2012) reported that finger millet, due to free competition for weeds in unweeded control plot, there was highest weed population throughout the crop growth.

Table.1 Weed population of *Cyperus iria* as influenced by different methods of tillage and conservation farming on finger millet

Treatment	Weed population of *Cyperus iria* (m^{-2})					
	15 DAS	30 DAS	45 DAS	60 DAS	90 DAS	At harvest
			Tillage method			
T1	20.99 (4.50)	26.14 (5.13)	13.32 (3.61)	10.64 (3.28)	9.09 (3.04)	6.93 (2.69)
T2	18.09 (4.22)	24.98 (5.00)	14.30 (3.75)	11.44 (3.38)	8.75 (2.96)	6.93 (2.69)
T3	17.91 (4.18)	21.46 (4.61)	13.25 (3.67)	9.79 (3.13)	8.85 (2.96)	5.92 (2.48)
SEm±	0.42	0.63	0.92	0.34	0.18	0.40
CD at 0.05	1.69	2.52	NS	NS	NS	NS
			Conservation farming			
C1	30.14 (5.53)	32.47 (5.74)	19.78 (4.17)	15.48 (3.99)	14.07 (3.81)	8.39 (2.98)
C2	27.58 (5.29)	29.48 (5.47)	17.36 (4.49)	15.17 (3.95)	13.33 (3.71)	9.28 (3.12)
C3	16.32 (4.09)	24.67 (5.00)	14.18 (2.82)	10.48 (3.29)	6.76 (2.69)	6.95 (2.71)
C4	11.87 (3.52)	17.95 (4.28)	10.15 (3.25)	6.83 (2.70)	5.88 (2.52)	4.62 (2.25)
C5	9.05 (3.09)	16.39 (4.09)	6.64 (2.66)	5.16 (2.37)	4.43 (2.21)	3.74 (2.03)
SEm±	0.48	0.63	0.92	0.45	0.55	0.27
CD at 0.05	1.41	3.06	2.70	1.33	1.61	0.79

The observations are square root transformed ($x\sqrt{x+0.5}$). Figures in parentheses indicate the square root transformed value.T1: Conventional tillage, T2: Minimum tillage, T3: Summer ploughing, C1: Open conservation, C2: Intercropping (finger millet + redgram), C3: Mulching, C4: Herbicide application, C5: C1+C2+C3+C4.

Table.2 Weed population of *Cyperus rotundus* as influenced by different methods of tillage and conservation farming on finger millet

Treatment	Weed population of *Cyperus rotundus* (m^{-2})					
	15 DAS	30 DAS	45 DAS	60 DAS	90 DAS	At harvest
		Tillage method				
T1	15.05 (3.81)	22.81 (4.95)	11.51 (3.34)	9.58 (3.06)	8.01 (2.83)	6.34 (2.55)
T2	16.03 (3.93)	24.97 (4.79)	11.04 (3.30)	8.96 (2.95)	9.45 (3.05)	7.44 (2.71)
T3	13.64 (3.62)	20.91 (4.57)	10.07 (3.19)	7.35 (2.73)	7.10 (2.67)	5.58 (2.41)
SEm±	0.62	0.59	0.39	0.67	0.26	0.45
CD at 0.05	NS	2.37	NS	NS	1.04	NS
		Conservation farming				
C1	23.70 (4.89)	27.96 (5.33)	16.13 (4.05)	12.96 (3.64)	14.34 (3.85)	9.31 (3.10)
C2	24.90 (5.02)	26.79 (5.21)	16.92 (4.15)	14.70 (3.85)	11.93 (3.50)	10.14 (3.23)
C3	10.56 (3.32)	24.75 (5.01)	8.60 (3.01)	6.00 (2.53)	6.42 (2.62)	5.86 (2.52)
C4	8.93 (3.07)	20.29 (4.55)	48.27 (2.95)	5.70 (2.48)	4.88 (2.31)	4.42 (2.20)
C5	6.42 (2.63)	13.69 (3.75)	4.45 (2.22)	3.77 (2.06)	3.39 (1.96)	2.54 (1.74)
SEm±	0.99	0.91	0.85	0.99	0.42	0.60
CD at 0.05	2.90	2.68	2.49	2.90	1.24	1.75

The observations are square root transformed (x√x+0.5). Figures in parentheses indicate the square root transformed value.T1: Conventional tillage, T2: Minimum tillage, T3: Summer ploughing, C1: Open conservation, C2: Intercropping (finger millet + redgram), C3: Mulching, C4: Herbicide application, C5: C1+C2+C3+C4

Table.3 Weed population of *Echinochloa colona* as influenced by different methods of tillage and conservation arming on finger millet

Treatment	Weed population of *Echinochloa colona* (m^{-2})					
	15 DAS	30 DAS	45 DAS	60 DAS	90 DAS	At harvest
		Tillage method				
T1	20.97 (4.33)	27.65 (5.22)	17.10 (3.76)	12.19 (3.49)	6.46 (2.57)	5.45 (2.38)
T2	21.56 (4.45)	25.82 (5.08)	14.52 (3.40)	12.74 (3.58)	6.55 (2.60)	5.32 (2.37)
T3	21.86 (4.46)	22.57 (4.76)	11.66 (4.14)	12.00 (3.49)	6.52 (2.61)	3.15 (1.87)
SEm±	0.36	0.76	0.82	0.20	0.40	0.25
CD at 0.05	NS	3.07	3.30	NS	NS	1.01
		Conservation farming				
C1	41.35 (6.46)	35.76 (6.01)	20.98 (4.62)	16.16 (4.07)	10.07 (3.24)	6.93 (2.71)
C2	36.56 (6.07)	32.38 (5.72)	20.00 (4.50)	17.94 (4.27)	9.33 (3.12)	6.38 (2.58)
C3	13.77 (3.77)	23.24 (4.86)	13.51 (3.71)	11.74 (3.49)	5.25 (2.39)	4.64 (2.25)
C4	8.79 (3.04)	19.46 (4.46)	10.30 (3.23)	8.61 (3.01)	4.57 (2.25)	3.15 (1.89)
C5	6.84 (2.71)	15.90 (4.05)	7.34 (2.77)	7.08 (2.75)	3.32 (1.95)	2.10 (1.60)
SEm±	1.10	0.72	1.06	0.39	0.44	0.37
CD at 0.05	3.22	2.12	3.12	1.15	1.28	1.08

The observations are square root transformed (x√x+0.5). Figures in parentheses indicate the square root transformed value.T1: Conventional tillage, T2: Minimum tillage, T3: Summer ploughing, C1: Open conservation, C2: Intercropping (finger millet + redgram), C3: Mulching, C4: Herbicide application, C5: C1+C2+C3+C4.

Table.4 Weed population of *Fimbristylis miliacea* as influenced by different methods of tillage and conservation farming on finger millet

Treatment	Weed population of *Fimbristylis miliacea* (m^{-2})					
	15 DAS	30 DAS	45 DAS	60 DAS	90 DAS	At harvest
			Tillage method			
T1	7.31 (2.74)	10.82 (3.31)	8.78 (3.02)	10.89 (3.33)	7.98 (2.78)	5.31 (2.36)
T2	8.55 (2.94)	12.88 (3.52)	7.22 (2.69)	9.62 (3.06)	7.34 (2.76)	6.02 (2.49)
T3	5.32 (2.37)	8.35 (2.92)	7.02 (2.65)	8.62 (2.90)	5.36 (2.36)	4.20 (2.14)
SEm±	0.38	0.43	0.26	0.79	0.11	0.37
CD at 0.05	1.52	1.73	1.03	NS	0.46	NS
			Conservation farming			
C1	10.37 (3.28)	14.52 (3.81)	11.26 (3.42)	14.69 (3.89)	11.07 (3.38)	6.94 (2.69)
C2	10.16 (3.24)	15.93 (4.04)	10.93 (3.37)	14.83 (3.90)	10.04 (3.22)	8.10 (2.91)
C3	6.79 (2.69)	11.08 (3.39)	6.96 (2.72)	8.06 (2.91)	6.17 (2.60)	4.55 (2.24)
C4	4.66 (2.26)	7.50 (2.82)	5.78 (2.46)	6.68 (2.64)	4.57 (2.23)	3.51 (2.00)
C5	3.32 (1.94)	4.39 (2.20)	3.42 (1.96)	4.30 (2.14)	2.61 (1.76)	2.79 (1.81)
SEm±	0.35	0.50	0.57	0.64	0.45	0.48
CD at 0.05	1.03	1.45	1.67	1.87	1.31	1.41

The observations are square root transformed (x√x+0.5). Figures in parentheses indicate the square root transformed value.T1: Conventional tillage, T2: Minimum tillage, T3: Summer ploughing, C1: Open conservation, C2: Intercropping (finger millet + redgram), C3: Mulching, C4: Herbicide application, C5: C1+C2+C3+C4.

Table.5 Weed population of *Spilanthes acmella* as influenced by different methods of tillage and conservation farming on finger millet

Treatment	**Weed population of *Spilanthes acmella* (m^{-2})**					
	15 DAS	30 DAS	45 DAS	60 DAS	90 DAS	At harvest
			Tillage method			
T1	7.90 (2.82)	13.46 (3.63)	10.29 (3.19)	7.35 (2.71)	7.10 (2.68)	5.99 (2.48)
T2	7.36 (2.75)	9.68 (3.10)	9.11 (3.00)	7.44 (2.74)	6.95 (2.43)	6.80 (2.65)
T3	4.97 (2.31)	8.52 (2.35)	11.17 (3.38)	8.40 (2.95)	5.61 (2.68)	4.55 (2.22)
SEm±	0.38	0.35	0.93	0.42	0.23	0.40
CD at 0.05	1.52	1.43	NS	NS	0.92	1.63
			Conservation farming			
C1	9.79 (3.18)	16.01 (4.02)	14.69 (3.89)	11.26 (3.42)	10.74 (3.33)	8.63 (2.99)
C2	9.82 (3.17)	15.90 (4.03)	14.83 (3.90)	11.27 (3.42)	8.38 (2.97)	7.73 (2.85)
C3	6.43 (2.62)	9.52 (3.15)	8.46 (2.98)	7.48 (2.82)	6.21 (2.59)	5.59 (2.45)
C4	4.50 (2.23)	6.95 (2.72)	7.89 (2.86)	5.29 (2.39)	4.71 (2.28)	4.17 (2.15)
C5	3.19 (1.91)	4.39 (2.20)	5.07 (2.30)	3.36 (1.95)	2.72 (1.79)	2.78 (1.80)
SEm±	0.38	0.53	0.66	0.45	0.28	0.45
CD at 0.05	1.52	1.57	1.95	1.32	0.83	1.33

The observations are square root transformed (x√x+0.5). Figures in parentheses indicate the square root transformed value.T1: Conventional tillage, T2: Minimum tillage, T3: Summer ploughing, C1: Open conservation, C2: Intercropping (finger millet + redgram), C3: Mulching, C4: Herbicide application, C5: C1+C2+C3+C4.

Table.6 Weed population of other weeds as influenced by different methods of tillage and conservation farming on finger millet

Treatment	Weed population of other weeds (m^{-2})					
	15 DAS	30 DAS	45 DAS	60 DAS	90 DAS	At harvest
			Tillage method			
T1	7.61 (2.80)	8.01 (2.87)	9.10 (3.06)	9.65 (3.12)	9.11 (3.01)	5.20 (2.33)
T2	6.80 (2.67)	7.95 (2.86)	7.67 (2.83)	8.14 (2.86)	9.50 (3.09)	5.50 (2.40)
T3	6.01 (2.52)	8.47 (2.97)	8.98 (3.00)	7.99 (2.86)	8.92 (2.98)	5.65 (2.44)
SEm±	0.37	0.54	0.54	0.47	0.19	0.44
CD at 0.05	NS	NS	NS	NS	NS	NS
			Conservation farming			
C1	9.12 (3.10)	11.66 (3.48)	11.90 (3.50)	13.31 (3.71)	14.16 (3.82)	7.84 (2.88)
C2	9.35 (3.12)	10.08 (3.25)	11.58 (3.45)	12.09 (3.54)	13.69 (3.76)	7.97 (2.90)
C3	6.84 (2.71)	7.51 (2.83)	8.31 (2.96)	7.74 (2.86)	8.65 (3.02)	5.36 (2.42)
C4	5.20 (2.39)	6.67 (2.67)	6.43 (2.63)	5.88 (2.50)	5.76 (2.50)	3.65 (2.03)
C5	3.52 (2.00)	4.78 (2.29)	4.69 (2.27)	3.95 (2.10)	3.62 (2.02)	2.44 (1.71)
SEm±	0.27	0.41	0.51	0.37	0.39	0.26
CD at 0.05	0.78	1.20	1.49	1.10	1.15	0.77

The observations are square root transformed ($x\sqrt{x+0.5}$). Figures in parentheses indicate the square root transformed value.T1: Conventional tillage, T2: Minimum tillage, T3: Summer ploughing, C1: Open conservation, C2: Intercropping (finger millet + redgram), C3: Mulching, C4: Herbicide application, C5: C1+C2+C3+C4.

Table.7 Weed density as influenced by different methods of tillage and conservation farming on finger millet

Treatment	Total weed spices (m^{-2})					
	15 DAS	30 DAS	45 DAS	60 DAS	90 DAS	At harvest
		Tillage method				
T1	80.19 (8.71)	109.06 (10.38)	69.72 (8.28)	62.96 (7.86)	49.99 (6.61)	36.56 (6.01)
T2	78.39 (8.61)	108.59 (10.34)	64.83 (7.94)	56.79 (7.38)	45.98 (6.98)	35.62 (5.88)
T3	68.09 (7.99)	90.54 (9.44)	60.40 (7.61)	52.77 (7.14)	40.18 (6.20)	29.80 (5.41)
SEm±	0.63	0.55	1.82	1.44	1.18	1.49
CD at 0.05	2.52	2.21	NS	5.79	4.77	NS
		Conservation farming				
C1	123.62 (11.14)	136.90 (11.71)	90.48 (9.53)	83.86 (9.18)	74.45 (8.65)	46.95 (6.85)
C2	116.87 (10.82)	129.50 (11.39)	92.47 (9.63)	84.15 (9.18)	63.81 (7.99)	49.07 (7.03)
C3	60.35 (7.79)	99.79 (10.00)	58.26 (7.64)	48.36 (6.97)	34.54 (5.90)	28.63 (5.38)
C4	42.92 (6.58)	81.13 (9.03)	49.13 (7.02)	39.44 (6.30)	29.82 (5.49)	26.00 (5.12)
C5	34.00 (5.86)	66.33 (8.16)	34.58 (5.90)	31.70 (5.66)	24.31 (4.95)	19.33 (4.44)
SEm±	1.82	2.24	2.65	1.44	1.60	1.57
CD at 0.05	5.35	6.57	7.78	5.81	4.68	4.60

The observations are square root transformed (x√x+0.5). Figures in parentheses indicate the square root transformed value.T1: Conventional tillage, T2: Minimum tillage, T3: Summer ploughing, C1: Open conservation, C2: Intercropping (finger millet + redgram), C3: Mulching, C4: Herbicide application, C5: C1+C2+C3+C4.

Table.8 Weed population of total weed dry weight as influenced by different methods of tillage and conservation farming on finger millet

Treatment	Total weed dry weight (m^{-2})					
	15 DAS	30 DAS	45 DAS	60 DAS	90 DAS	At harvest
		Tillage method				
T1	2.19 (1.62)	25.69 (5.06)	45.41 (6.71)	46.00 (6.76)	53.60 (7.29)	52.12 (7.19)
T2	2.15 (1.60)	24.50 (4.96)	42.56 (6.53)	43.85 (6.59)	56.41 (7.46)	50.03 (7.04)
T3	1.75 (1.48)	20.96 (4.58)	41.40 (6.43)	43.84 (6.62)	54.90 (7.35)	48.04 (6.90)
SEm±	0.04	0.58	0.79	1.42	1.25	1.51
CD at 0.05	0.16	2.33	NS	NS	NS	NS
		Conservation farming				
C1	2.88 (1.83)	32.18 (5.71)	54.44 (7.41)	58.06 (7.64)	77.66 (8.84)	64.72 (8.06)
C2	3.01 (1.87)	30.31 (5.53)	52.35 (7.26)	56.03 (7.50)	67.91 (8.26)	64.71 (8.06)
C3	1.86 (1.53)	22.07 (4.73)	43.53 (6.62)	37.80 (6.17)	49.64 (7.07)	48.04 (6.95)
C4	1.23 (1.31)	18.16 (4.31)	34.56 (5.92)	38.01 (6.20)	42.64 (6.56)	38.94 (6.27)
C5	1.16 (1.28)	15.87 (4.03)	30.74 (5.58)	32.91 (5.77)	37.00 (6.11)	33.93 (5.86)
SEm±	0.04	1.00	1.28	1.46	1.87	1.85
CD at 0.05	0.27	2.95	3.75	4.28	5.50	5.43

The observations are square root transformed (x√x+0.5). Figures in parentheses indicate the square root transformed value.T1: Conventional tillage, T2: Minimum tillage, T3: Summer ploughing, C1: Open conservation, C2: Intercropping (finger millet + redgram), C3: Mulching, C4: Herbicide application, C5: C1+C2+C3+C4.

Table.9 Test weight, Stover yield, Yield, HI finger millet as influenced by different tillage and conservation farming

Treatment	Test weight (g)	Stover yield (q ha^{-1})	Yield (q ha^{-1})	HI
		Tillage Methods		
T1	2.34	64.87	24.11	25.31
T2	2.42	72.10	26.09	29.35
T3	2.47	74.11	26.89	26.88
SEm±	0.01	1.73	0.89	0.59
CD at 0.05	0.05	6.95	0.44	2.38
		Conservation farming		
C1	2.26	70.75	22.91	24.70
C2	2.24	50.01	22.58	31.33
C3	2.35	76.39	25.39	25.12
C4	2.48	73.55	27.56	27.54
C5	2.72	81.11	30.03	27.22
SEm±	0.04	2.98	0.74	1.08
CD at 0.05	0.13	8.76	2.18	3.16

T1: Conventional tillage, T2: Minimum tillage, T3: Summer ploughing, C1: Open conservation, C2: Intercropping (finger millet + redgram), C3: Mulching, C4: Herbicide application, C5: C1+C2+C3+C4.

Population of *Spilanthes acmella* (m^{-2})

Population of *Spilanthes acmella* finger millet field was recorded at 15, 30, 45, 60, 90 DAS and at harvest and data are presented in Table 5 the data showed that population of *Spilanthes acmella* was significantly affected by different treatments. At 15, 30 and 90 DAS treatment T_1 (Conventional tillage) recorded significantly higher population which was at par with T_2 (Minimum tillage) at 15 and 90 DAS. At harvest T_2 (Minimum tillage) recorded significantly higher population and it was at par with treatment T_1 (Conventional tillage). In conservation farming, treatment C_2 (Intercropping with redgram) produced more population of *Spilanthes acmella* at 15, 45 and 60 DAS but it was recorded statistically on par with C_1 (Opening conservation) at 15, 45 and 60 DAS. At 30, 90 DAS and at harvest treatment C_1 (Opening conservation) recorded significantly higher weed population (*Spilanthes acmella*) and it was on par with C_2 (Intercropping with redgram) at 30 DAS and at harvest. Gowda *et al.*, (2012) concluded that in finger millet the highest grain and straw yield was obtained in butachlor applied plots. Efficient control of weeds is necessary to increase the yield. Integrated weed management with combination of chemical, mechanical and hand weeding, exhibited efficient weed control and higher yield.

Population of other weeds (m^{-2})

The data on population of other weeds of finger millet field are presented in Table 6 data reveals that population of other weeds was unaffected due to different tillage treatment at different growth stages. Conservation farming recorded significantly higher population of other species of weed at 30, 45, 60 and 90 DAS but it was at par with C_2 (Intercropping with redgram) at 45 and 90 DAS. Whereas, treatment C_2 (Intercropping with redgram) recorded higher population of other spices of weeds at 15 DAS and at harvest and, it was at par with C_1 (Opening conservation) at respective date of observation.

Weed density (m^2)

Data recorded on weed density of finger millet are presented in Table 7 the data reveals that the tillage method recorded significantly effect on weed density. Weed density significantly higher in treatment T_1 (Conventional tillage) at 15, 30, 60 and 90 DAS which was at par with treatment T_2 (Minimum tillage) at 15, 30 and 90 DAS. Gowda *et al.*, (2012) reported that the density of *Cyperus rotundus, Digitaria marginata*, *Cynodon dectylon*, *Commelina benghalensis, Ageratum conyzoides and S. acmella* was in higher proportion at 30, 60 DAS and at harvest. It might be due to conventional and minimum tillage was made better tilth for weed germination and growth during the cropping season. In conservation farming highest weed density was recorded in treatment C_1 (Opening conservation) at 15, 30, 90 DAS and treatment C_2 (Intercropping with redgram) observed more weed density at 45, 60 DAS. It might be due to treatment open conservation and intercropping with redgram was forced weed germination. Redgram grow very slow which was not covered the ground area and weed become very fast growth.

Total dry weight (g m^{-2})

The data on weed dry weight as influenced by different tillage and conservation farming Table 8 treatment T_1 (Conventional tillage) recorded higher weed dry matter at 15 DAS which was recorded on par to the treatment T_2 (Minimum tillage). Whereas, treatment T_2 (Minimum tillage) recorded higher weed dry matter at 30 DAS which was on par with treatment T_1 (Conventional tillage) at 45, 60, 90 DAS and at harvest it was unaffected due to different tillage method. It might be due to treatment Conventional tillage and Minimum tillage plot produce higher weed population per meter square than the summer ploughing. In case of conservation farming, treatment C_1 (Opening conservation) recorded higher weed dry matter and it was produce statistically similar dry matter in treatment C_2 (Intercropping with redgram) during the experimentation. It was also due to opening conservation and intercropping field was produced higher weed biomass than the mulch and herbicide application of treatments. Naik *et al.,* (2000) revealed that the butachlor-treated plots (either with or without earthing-up) had significantly more dry matter of the finger millet. Crop in weed-free plots also registered the highest uptake of major nutrients and was on a par with butachlor-treated plots. Grain and straw yield in these two treatments were significantly higher than those of other treatments.

1000-seed weight (g)

Thousand seed weight of finger millet was affected by different treatments and the data are given in Table 9 treatment T_3 (Summer ploughing) produced significantly higher thousand seed weight which was on par with T_2 (minimum tillage) and lowest thousand seed weight recorded in treatment T_1 (Conventional tillage). Whereas, treatment C_5 produced highest thousand seed weight among all the treatment in conservation farming.

Stover yield and grain yield (q ha^{-1})

Data presented in Table 9 reveals that stover yield and grain yield had significantly highest in treatment T_3 (Summer poluging) which was at par with treatment T_2 (Minimum tillage) in stover yield and lowest stover yield was recorded in treatment T_1 (Conventional tillage). Borin and Sartori (1996) reported that among conventional tillage, minimum tillage and no-tillage in maize growing the highest yield had been obtained with the conventional tillage. In case of conservation farming, stover and grain yield had significantly highest in treatment C_5 (C_1+C_2+C_3+C_4) which as at par with treatment C_3 (Mulching) in stover yield Samarajeewa *et al.,* (2006) observed that the use of cover crop must be justified economically by no herbicide input and increased yield. The grain yield and straw yield reduced considerably when intercropping with legume compared to sole crop of finger millet as reported by Singh and Arya (1999) and Mitra *et al.,* (2001). Acquah (2002), who elaborated that supply of moisture at critical stages of growth results in higher yields. Prasad *et al.,* (1991) recorded that the weeds reduced yield of finger millet by 55-61 per cent and hand weeding twice gave the highest grain yield. Singh and Arya (1999) also noted similar findings.

Harvest index (HI)

Harvest index was significantly affected by different treatment Table 9 the data reveals that T_2 (Minimum tillage) recorded significantly highest harvest index among tillage treatments. Whereas, in conservation farming treatment C_2 (Intercropping with redgram) recorded significantly highest harvest index among all the conservation farming and lowest harvest index was recorded in treatment C_1 (Opening conservation).

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