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Conservation farming practices to mitigate the effects of climate change

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Abstract
To study the effect of tillage practices in different cropping sequences with nutrient sources on soil health, the experiment was initiated in the Eastern block farm of Tamil Nadu Agricultural University, Coimbatore, Tamil nadu. The treatments are tillage practices, cropping sequences as main plots and mulch and nutrient sources as sub plots. The results indicated that in the cotton - green gram cropping sequence, higher cotton equivalent yield of 3413 kg/ha was recorded in mulch + 75% recommended dose of fertilizers and 25% N through organics. Among the tillage practices, conventional tillage registered highest cotton equivalent yield of 3382 kg/ha and followed by minimum tillage (3117 kg/ha). Irrespective of tillage and cropping, higher cotton equivalent yield recorded in mulch + 75% recommended dose of fertilizers and 25% N through organics (3014 kg/ha) which was on par with 100% RDF with mulch of 2902 kg/ha and no mulch with 75% RDF and 25% N through organics. Over all higher cotton equivalent yield of 4390 kg/ha was recorded in bhendi- maize cropping sequence. As a cropping sequence, bhendi maize registered higher residue addition and the lowest was in the cotton – greengram sequence. Sequence as a whole, high total carbon removal could be possible with bhendi - maize sequence and higher carbon stock achieved in the bhendi - maize cropping sequence under minimum tillage with mulch + 75% recommended dose of fertilizer + 25% through organics.

Keywords: tillage, cropping sequence, mulching, yield, carbon removal, soil temperature

1. Introduction
Nowadays farming practice seeks to increase the food security, conserve biodiversity and safeguard environment i.e conservation agriculture. Conservation agriculture practices can contribute to making agricultural systems more resilient to climate change. It includes soil management that minimize the disruption of the soil structure, composition and natural biodiversity. Conservation agriculture main aim is less disturbance the soil. i.e. plant directly into the soil, without hoeing, secondly keep the soil covered as much as possible, i.e mulch, special cover crops or crop residues left on the field protect the soil from erosion and limit weed growth throughout the year and thirdly mixes and rotate crops i.e. planting the crops in the same field, and rotating crops from season to season. This allows a breakdown of survival and multiplication cycles of pests, diseases and weeds resulting in higher yields and maintenance of soil fertility.

Conservation agriculture is a mechanism to adapt to climate change by increasing resilience to drought and improve soil health. Increasing temperature would increase oxidation of the organic carbon in soil. Its levels will go down further. These changes may reflect themselves in poorer soil fertility, loss of soil biota, water stress and ground water depletion (FAO, 2011) [3]. The ecological benefits from conservation agriculture are operationally defined as increase in soil fertility, retention of soil moisture, long-term yield increase, decreasing yield variations, greater food security, increased growing time of an area and production per Ha. (Natural Resources Conservation Service, 1995) [6].

These conservation practices have been proven to reduce farming systems greenhouse gas emissions and enhance their role as carbon sinks. Conservation agriculture is a more sustainable and environmental friendly management system for cultivating crops. The farming in future will have to sustainably produce more food from less land through more efficient use of natural resources and with minimal impact on the environment in order to meet growing population demands. Promoting and adopting conservation management systems can help meet this goal and tillage. The hypothesize of the research is that both tillage and crop rotation have great impact on soil carbon. The work will be region and soil specific.

Thus, the objective of this study was to determine the effect of crop rotation, nutrient sources and tillage on crop productivity and soil health sustenance.

Materials and methods

To study the effect of conservation farming practices like tillage practices in different cropping sequences with nutrient sources on soil health, the experiment was initiated in the Eastern block farm of Tamil Nadu Agricultural University, Coimbatore during 2012-13. Totally three cropping cycles were completed up to 2015-16.The treatments are tillage practices (minimum and conventional) and cropping sequences (CS_1: cotton - green gram, CS_2: vegetable cowpea – sunflower, CS_3: red gram – maize, CS_4: bhendi – maize) as main plots and mulch (M_1 : No mulch, M_2: crop residue mulch (crop residue recycled as in- situ) and nutrient sources (F_1 : Recommended Dose of Fertilizer (RDF), F_2: 75% RDF + 25% N through Organic Manure) as sub plots. Different levels of fertilizers were applied as per treatment schedule for different cropping sequences (table1 and 2). The post harvest soil samples were collected after three years and analysed for carbon content and worked out the carbon stock and other soil health parameters.

To study the effect of tillage, residue and fertilizer levels on soil temperature, the soil thermometer was used to measure the temperature. The instrument was inserted at a depth of 0-10 cm height on the top layer of the soil and reading was noted. The mean maximum and minimum temperature of the study site showed considerable fluctuations during different parts of the year. Summer temperature reaches up to 39°C, while winter in December and January and minimum temperature up to 20.5°C.In the minimum tillage cultivator one time and in the conventional tillage disking followed by cultivator two times followed. Oxidizable soil organic carbon was estimated using (Walkley and Black, 1934) [13] rapid titration method, using a diphenyl amine indicator. The carbon stock was worked out by multiplying carbon content (%) with bulk density (g/cm3) and depth in cm. The initial soil characteristics of the soil properties viz.,pH-8.12,EC-0.30 dS/m, organic carbon-4.8g/kg, available N- 218 kg/ha, available P-17.1 kg/ha and available K 438 kg/ha. To study the climate change mitigation parameters, above ground carbon removal by biomass, soil temperature, and economics were worked out.

Results and discussion

Influence of farming practices on crop productivity

To compare and identify the suitable farming practices, the crop economic yield was converted into cotton equivalent yield and the results are discussed. In the Cotton - green gram cropping sequence, (table 3) higher cotton equivalent yield of 3413 kg/ha was recorded in mulch + 75% recommended dose of fertilizers and 25% N through organics which is statistically on par with mulch +100 % RDF (3265 kg/ha) and the lower yield was recorded in 100 % RDF alone without mulch (3093 kg/ha). Among the tillage practices, conventional tillage registered highest cotton equivalent yield of 3382 kg/ha and followed by minimum tillage (3117 kg/ha). The same trend of results registered in all other three cropping sequences. Results also indicated that irrespective of the cropping sequence conventional tillage recorded higher economic yield (2956 kg/ha) (fig1). Irrespective of tillage and cropping, higher cotton equivalent yield recorded in mulch + 75% recommended dose of fertilizers and 25% N through organics (3014 kg/ha) which was on par with 100% RDF with mulch of 2902 kg/ha and no mulch with 75% RDF and 25% N through organics. Over all higher cotton equivalent yield of 4390 kg/ha was recorded in bhendi- maize cropping sequence followed by cotton-green gram (3250 kg/ha). The results also in corroboration with Nill and Nill (1993) [7] that, the higher number of grains per cob in the wheat straw mulch treatments might be due to changes in soil physical, chemical and biological characteristics

Tolk *et al*. (1999) [11] also observed that mulches applied soil increased the grain yield significantly as compare with bare soil. Khurshid *et al*. (2006) [5] observed that the interaction effect of mulching and tillage for number of cobs per plant was significant. Such results were given by Khaliq *et al*. (2007) [4] who reported that different organic and inorganic sources showed non significant effect on number of cobs per plant.

Taller plants in the conventional tillage and wheat straw mulch might be due to good soil physical conditions and more water conservation under the wheat straw mulch. Such results were also observed by those of Pervez *et al*. (2009) [9] and Vetsch and Randall (2002) [12] who reported that greater plant height, grain yield and biological yield was also seen in case of mulching with tillage.

Influence of farming practices on residue addition

After harvesting, the residues were quantified and incorporated in the soil as per treatments. In the conventional tillage the residues were added with help of rotary weeder and in the minimum tillage the residues were added by pulling out and incorporated after adding water by trampling. Among the different technologies tillage and residue addition plays an important role to maintain soil quality. The carbonaceous part of the materials is used for the production of energy and microbial tissue. The amount of residue addition through different crops directly related to microbes multiplication and then soil carbon build up. Hence quantification of residues is more essential to relate this scientific fact. Quantification of residues done for both the season. During *kharif* season, in the cowpea crop, higher residues of 3940 kg/ha was added in mulch + 100% recommended dose of fertilizers conventional tillage followed by minimum tillage in the cowpea (table4). During *rabi*, season, higher residues of maize (7165 kg/ha) was recorded in mulch with 75 RDF and 25% organics followed by with mulch + 100 % RDF (6894 kg/ha) (Table 5). As a cropping sequence, bhendi maize registered higher residue addition and the lowest was in the cotton –greengram sequence (fig2).

Influence of farming practices on above ground biomass and carbon removal

To study the role of farming practices to mitigate climate change, calculation of carbon removal by the crops is important. Hence total plant biomass was worked for the whole cropping sequence by adding economic yield and stubbles/stalk etc., The results indicated that during *kharif* season, higher plant biomass was recorded in the cotton crop with mulch + 75% recommended dose of fertilizers and 25% N through organics (6891 kg/ha) (table 6). During *rabi* season, higher plant biomass was recorded in maize crop at same manure treatment of mulch with 75% recommended dose of fertilizer and 25% N through organics (13439 kg/ha) (table7). After adding two season crops the total carbon removal was high in the bhendi - maize sequence of 8085 kg C/ha/yr with mulch + 75% recommended dose of fertilizers and 25% N through organics (Table 8) (fig 3).

Influence of farming practices on soil temperature

Temperature of soil is one of the chief factors influencing the activity of plants and soil organism, and the chemical reactions that take place in the soil. In the cotton-greengram cropping sequence, the minimum tillage recorded comparatively lower value (33.58 ºC) than conventional tillage practice (41.56 ºC) (table 9). Among the nutrient practices, mulch at 75% fertilizer and 25% organics registered lower soil temperature of 36.07 ºC followed by no mulch with 75% fertilizer and 25% organics (37.72 ºC). In the interaction, the conventional tillage practice with no mulch + 100% RDF recorded higher soil temperature of 42.97ºC which is on par with mulch 100 % fertilizer (41.10 ºC). The lowest soil temperature of 32.83 º C was recorded with mulch at 75% fertilizer and 25% organics in minimum tillage. The same type of result observed in other cropping sequences also. Irrespective of the cropping system, fertilizer at 75% with 25% organics with residue addition, recorded lower soil temperature of 37.59 ºC which is on par with same treatment without mulch (38.60 ºC). The higher soil temperature recorded in the no mulch +100 % RDF (fig4). Aulakh *et al*. (2000) [1] reported that, organic mulches improve pleasant soil temperature, hinder weed growth, lessen soil moisture evaporation and improve the visual qualities of landscapes. Reddy *et al*. (2002) [10] reported that the incorporation of crop residues like wheat straw combined with fertilizer and tillage practices improved soil physical characteristics.

Influence of farming practices on soil carbon stock

The results on soil carbon indicated that irrespective of other treatments, the cropping sequence bhendi - maize recorded higher carbon stock of 11.24 t/ha/yr followed by cotton - green gram (10.86 t/ha/yr) (fig5). Irrespective of cropping sequence and manures, the minimum tillage recorded higher C stock of 10.92 t/ha/yr than conventional tillage (10.72 t/ha/yr). Among the manure treatments, irrespective of crops and tillage, with mulch + 75% recommended dose of fertilizers and 25% N through organics recorded higher C stock of 11.20 t/ha/yr followed by mulch with 100 % recommended dose fertilizers. Chaudhry *et al*. (2004) [2] reported that by using mulch the electrical conductivity of soil decreases 53% as compare to unmulched treatments. Bulk density is significantly decreased by enhancing tillage practices (Khurshid *et al*., 2006) [5].

Influence of farming practices on economics

Irrespective of the cropping sequence, 75% recommended dose of fertiliser + 25% N through organics with mulch recorded higher benefit cost ratio of 3.21 and this was followed by 100% fertiliser without mulch (3.12) (Table10). Though there is a low yield in minimum tillage than conventional tillage there was no marked difference among tillage practices, might be because of reduced cost of cultivation in minimum tillage. Among the different cropping sequence, bhendi - maize cropping sequence recorded higher benefit cost ratio of 3.6 and it was followed by cotton - green gram cropping sequence (3.3).

Table 1: Kharif -Planting details

CS	Crop	Variety	Fertilizer Kg/ha N, P, K	Spacing (cm)	Seed rate (kg/ha)	Duration (days)
CS_1	Cotton	Bunny - Bt	150:75:75	90 x 60	1.350	140
CS_2	Veg. Cowpea	CO 2	25:50:25	30 x 15	25.0	90
CS_3	Red gram	VBN(Rg) 3	25:50:25	60 x 30	25.0	110
CS_4	Bhendi	Slender	200:100:100	60 x 30	2.5	120

Table 2: Rabi - Planting details

CS	Crop	Variety	Fertilizer Kg/ha N, P, K	Spacing (cm)	Seed rate (kg/ha)	Duration (days)
CS_1	Green gram	Vamban 2	25:50:25	30 x 10	20	80
CS_2	Sunflower	Sunbreed	60:90:60	60 x 30	4	100
CS_3	Maize	NK 6240	150: 62.5:50	60 x 20	20	110
CS_4	Maize	NK 6240	150:62.5:50	60 x 20	20	110

Table 3: Influence of innovative farming practices on cotton equivalent yield of different cropping sequence

Manure Treatments	Cotton - Green gram (kg/ha)			Veg. Cowpea - Sunflower (kg/ha)			Red gram - Maize (kg/ha)			Bhendi - Maize (kg/ha)		
	Mini. Tillage	Con. tillage	Mean	Mini. tillage	Con. tillage	Mean	Mini. Tillage	Con. Tillage	Mean	Mini. tillage	Con. Tillage	Mean
NM 100% RDF	2991	3195	3093	1877	2015	1946	1967	2027	1997	3990	4071	4030
NM 75% RDF+25% OM	3101	3356	3229	1983	2039	2011	2007	2067	2037	4061	4187	4124
WM 100% RDF	3116	3413	3265	2027	2112	2070	2060	2147	2104	4096	4248	4172
WM 75% RDF+25% OM	3261	3564	3413	2077	2229	2153	2135	2230	2183	4226	4390	4308
Mean	3117	3382	3250	1991	2099	2045	2042	2118	2080	4093	4224	4158
	SEd	CD (P=0.05)		SEd	CD (P=0.05)		SEd	CD (P=0.05)		SEd	CD P=0.05)	
T	140.5	284		80.4	162		66.9	134		54.2	110	
M	148.2	268		69.7	138		85.3	171		75.7	152	
T at M	126.8	265		67.2	135		57.3	116		89.6	161	
M at T	125.7	254		63.5	128		68.2	138			142	

(NM - No Mulch; WM - With Mulch; RDF - Recommended Dose of Fertilizer, OM - Organic Manure); MT-minimum tillage, CT-conventional tillage)

Table 4: Quantification of residues in the experiment of innovative farming practices - *kharif season*

Treatments	Cotton (kg/ha)		Veg. cowpea (kg/ha)		Red gram (kg/ha)		Bhendi (kg/ha)	
	Mini. Tillage	Con. tillage	Mini. tillage	Con. tillage	Mini. Tillage	Con. Tillage	Mini. Tillage	Con. Tillage
NM 100% RDF	--	--	--	--	--	--	--	--
NM 75% RDF+25% OM	--	--	--	--	--	--	--	--
WM 100% RDF	3089	2787	3154	3940	2554	2428	2790	2684
WM 75% RDF+25% OM	2875	2935	3328	3088	2828	2686	2832	2956

(NM - No Mulch; WM - With Mulch; RDF - Recommended Dose of Fertilizer; OM - Organic Manure); T-tillage; M - Manure combinations

Table 5: Residue addition in different treatment in tillage, residues and nutrient management practices – *rabi season*

Treatments	Green gram (kg/ha)		Sunflower (kg/ha)		Maize (kg/ha)		Maize (kg/ha)	
	Mini. Tillage	Con. tillage	Mini. tillage	Con. tillage	Mini. Tillage	Con. Tillage	Mini. tillage	Con. Tillage
NM 100% RDF	--	--	--	--	--	--	--	--
NM 75% RDF+25% OM	--	--	--	--	--	--	--	--
WM 100% RDF	1156	1358	3453	3848	6328	6894	6018	6443
WM 75% RDF+25% OM	1278	1487	3724	4084	6742	7165	6285	6683

(NM - No Mulch; WM - With Mulch; RDF - Recommended Dose of Fertilizer, OM - Organic Manure); MT-minimum tillage, CT-conventional tillage)

Table 6: Total plant biomass (kg/ha) of different crops – *kharif season*

Treatments	Cotton (kg/ha)		Veg. cowpea (kg/ha)		Red gram (kg/ha)		Bhendi (kg/ha)	
	Mini. Tillage	Con. tillage	Mini. tillage	Con. tillage	Mini. Tillage	Con. Tillage	Mini. Tillage	Con. Tillage
NM 100% RDF	6239	6827	3625	4006	2997	3132	4099	4346
NM 75% RDF+25% OM	6411	6733	3917	4292	3279	3455	4427	4606
WM 100% RDF	6333	6862	3669	4036	3025	3217	4254	4568
WM 75% RDF+25% OM	6542	6891	3975	4378	3315	3509	4466	4827

Table 7: Total plant biomass (kg/ha) of different crops rabi season

Treatments	Green gram (kg/ha)		Sunflower (kg/ha)		Maize (kg/ha)		Maize (kg/ha)	
	Mini. Tillage	Con. tillage	Mini. tillage	Con. tillage	Mini. Tillage	Con. Tillage	Mini. tillage	Con. Tillage
NM 100% RDF	1830	2016	5237	5504	12041	12853	12096	12581
NM 75% RDF+25% OM	1964	2181	5564	5826	12554	13093	12318	12910
WM 100% RDF	1868	2122	5348	5756	12413	13112	12236	12992
WM 75% RDF+25% OM	2020	2283	5678	6068	13020	13647	12798	13439

(NM - No Mulch; WM - With Mulch; RDF - Recommended Dose of Fertilizer, OM - Organic Manure); MT-minimum tillage, CT-conventional tillage)

Table 8: Total carbon removal (kg/ha) by the different cropping sequence to mitigate climate change

Manure Treatments	Cotton - Green gram (kg/ha)			Veg. Cowpea - Sunflower (kg/ha)			Red gram - Maize (kg/ha)			Bhendi - Maize (kg/ha)		
	Mini. Tillage	Con. tillage	Mean	Mini. tillage	Con. tillage	Mean	Mini. Tillage	Con. Tillage	Mean	Mini. tillage	Con. Tillage	Mean
NM 100% RDF	3818	4184	4001	3988	4280	4134	6677	7096	6887	7167	7491	7329
NM 75% RDF+25% OM	3961	4213	4087	4266	4553	4410	7032	7350	7191	7412	7753	7583
WM 100% RDF	3880	4263	4072	4058	4406	4232	6853	7249	7051	7298	7772	7535
WM 75% RDF+25% OM	4049	4321	4185	4344	4701	4523	7254	7619	7437	7641	8085	7863
Mean	3927	4245	4086	4164	4485	4325	6954	7329	7141	7380	7775	7577

(NM - No Mulch; WM - With Mulch; RDF - Recommended Dose of Fertilizer, OM - Organic Manure); MT-minimum tillage, CT-conventional tillage)

Table 9: Influence of innovative farming practices on soil temperature in different cropping sequence

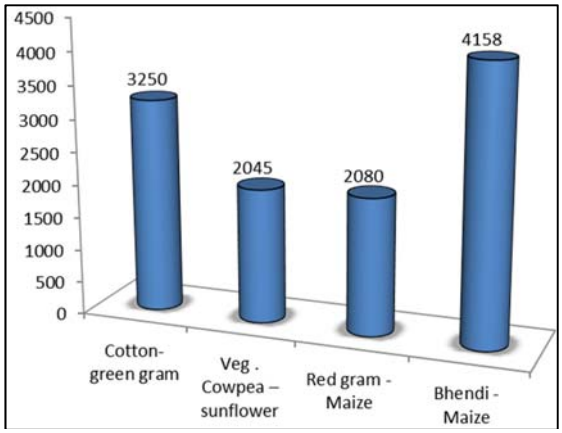
Treatments	Cotton-Green gram (ºC)			Veg. cowpea-sunflower (ºC)			Red gram –maize (ºC)			Bhendi-Maize (ºC)		
	Mini. Tillage	Con. Tillage	Mean	Mini. Tillage	Con. Tillage	Mean	Mini. Tillage	Con. Tillage	Mean	Mini. Tillage	Con. Tillage	Mean
NM 100% RDF	34.77	42.97	38.87	40.3	43.13	41.72	39.87	40.83	40.35	38.69	42.07	40.38
NM 75% RDF+25% OM	35.80	40.87	37.72	38.07	41.03	39.55	36.96	37.87	37.42	37.57	40.60	39.09
WM 100% RDF	34.33	41.10	38.34	37.94	42.33	40.14	39.09	41.00	40.05	38.83	41.20	40.02
WM 75% RDF+25% OM	32.83	39.30	36.07	36.83	40.03	38.43	36.52	39.03	37.78	36.85	40.93	38.89
Grand mean	33.58	40.20	36.86	37.39	41.18	39.28	37.81	40.02	38.90	37.84	41.07	39.45
			T			M		T at M		Mat T		
SEd												
CD(P=0.05)			3.40			2.03		2.24		3.21		

(NM - No Mulch; WM - With Mulch; RDF - Recommended Dose of Fertilizer, OM - Organic Manure); MT-minimum tillage, CT-conventional tillage)

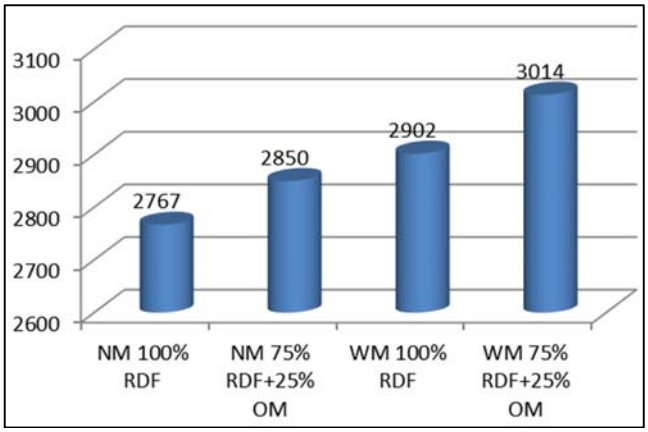
Table 10: Influence of innovative farming practices on economics in different cropping sequence

Manure Treat -ments	Cotton - Green gram (kg/ha)				Veg. Cowpea - Sunflower (kg/ha)				Red gram - Maize (kg/ha)				Bhendi - Maize (kg/ha)				Mean			
	Net ret. (Rs./ha)		BC Ratio		Net ret. (Rs./ha)		BC Ratio		Net ret. (Rs./ha)		BC Ratio		Net ret. (Rs./ha)		BC Ratio		Net ret. (Rs./ha)		BC Ratio	
	MT	CT	MT	CT	MT	CT	MT	CT	MT	CT	MT	CT	MT	CT	MT	CT	MT	CT	MT	CT
NM 100% RDF	86400	94050	3.42	3.48	58100	62750	2.63	2.65	62600	63350	2.75	2.67	146750	148550	3.78	3.7	88463	92175	3.14	3.12
NM 75% RDF+25% OM	86050	95850	3.11	3.23	58400	58950	2.43	2.37	59600	60350	2.46	2.4	145300	149350	3.52	3.49	87338	91125	2.88	2.87
WM 100% RDF	90550	101100	3.46	3.59	64600	66600	2.76	2.71	66250	68350	2.8	2.75	151050	156400	3.81	3.79	93113	98113	3.21	3.21
WM 75% RDF+25% OM	92600	103350	3.27	3.4	63100	68450	2.55	2.59	66000	68500	2.62	2.59	153550	159500	3.66	3.66	93813	99950	3.02	3.06
Mean	88900	98588	3.32	3.43	61050	64188	2.59	2.58	63613	65138	2.66	2.6	149163	153450	3.69	3.66	90681	95341	3.06	3.07

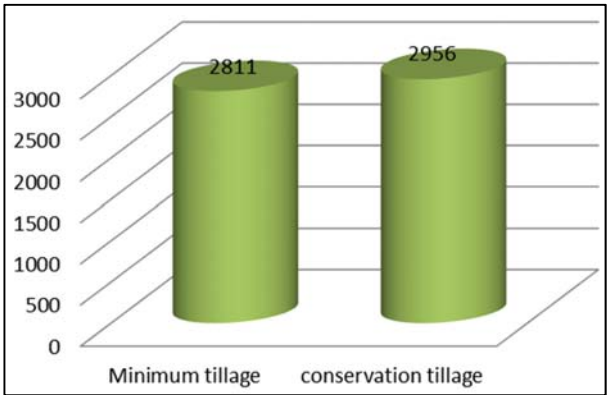
(NM - No Mulch; WM - With Mulch; RDF - Recommended Dose of Fertilizer; OM - Organic Manure, MT-minimum tillage, CT-conventional tillage)



Cotton equivalent yield of different cropping sequences

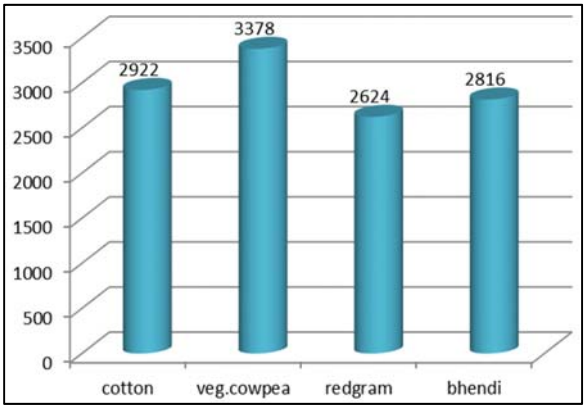


Cotton equivalent yield influenced by different nutrient practices

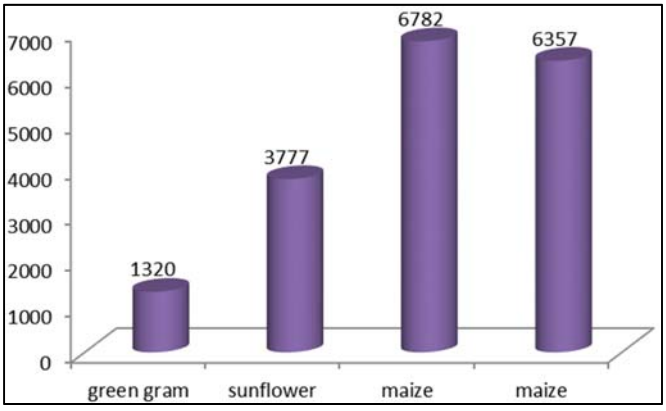


Cotton equivalent yield influenced by tillage practices

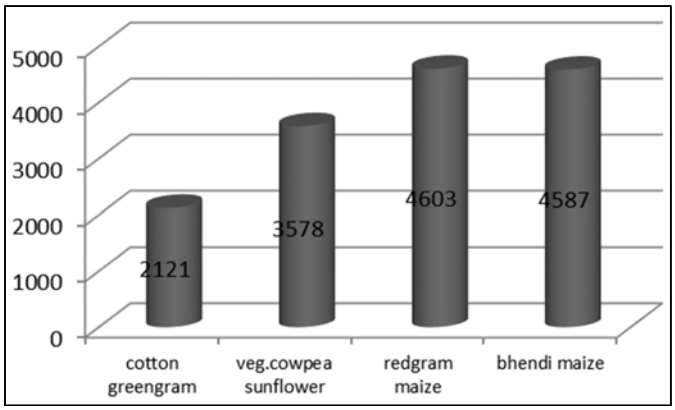
Fig 1: Cotton equivalent yield influenced by different factors



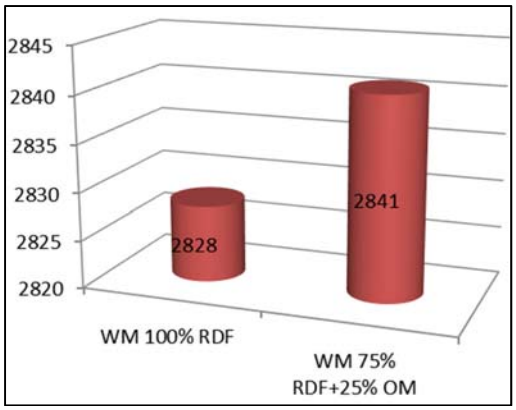
Residue addition Influenced by crops -kharif season



Residue addition Influenced by crops -rabi season

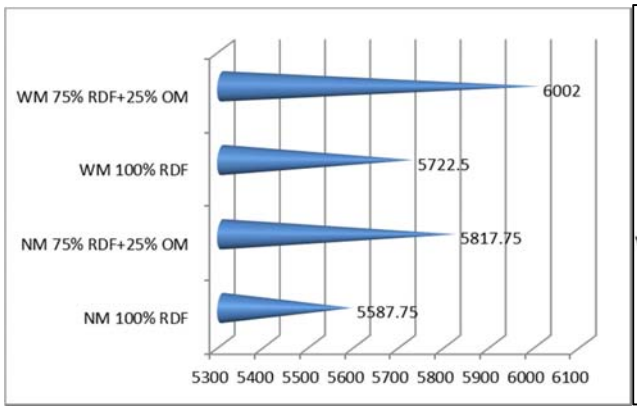


Residue addition Influenced by cropping sequences

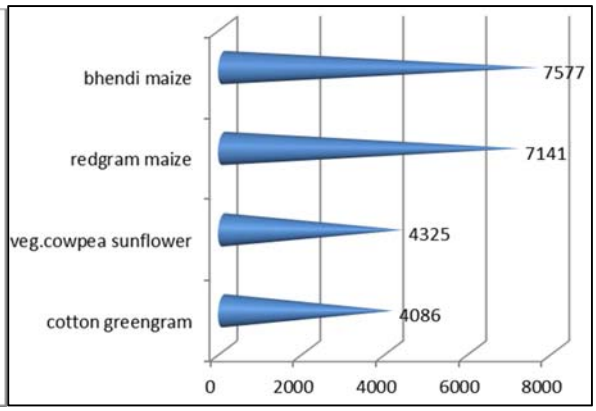


Residue addition influenced by nutrient practices

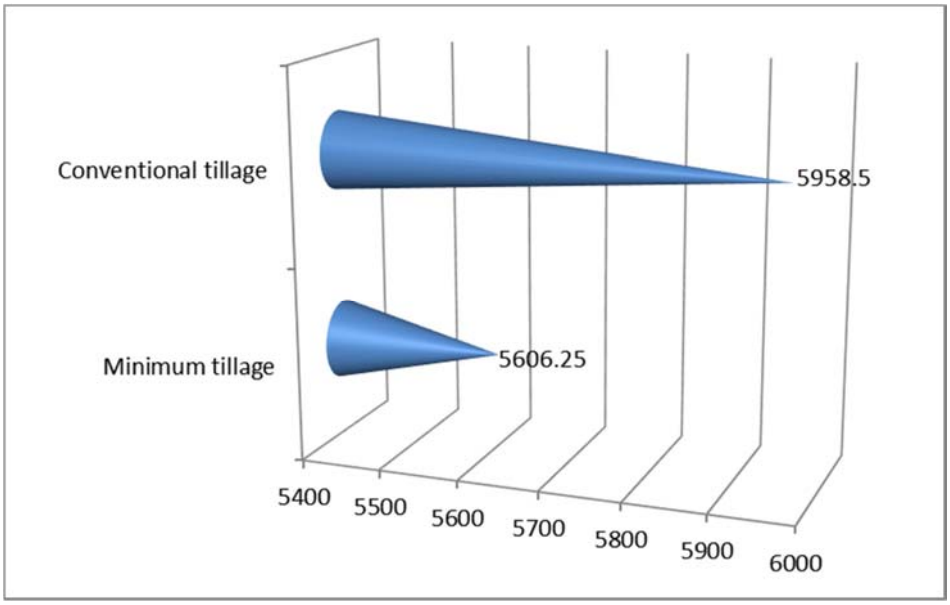
Fig 2: Residue addition as influenced by different factors



Total carbon removal (kg/ha) by the different manurial treatments

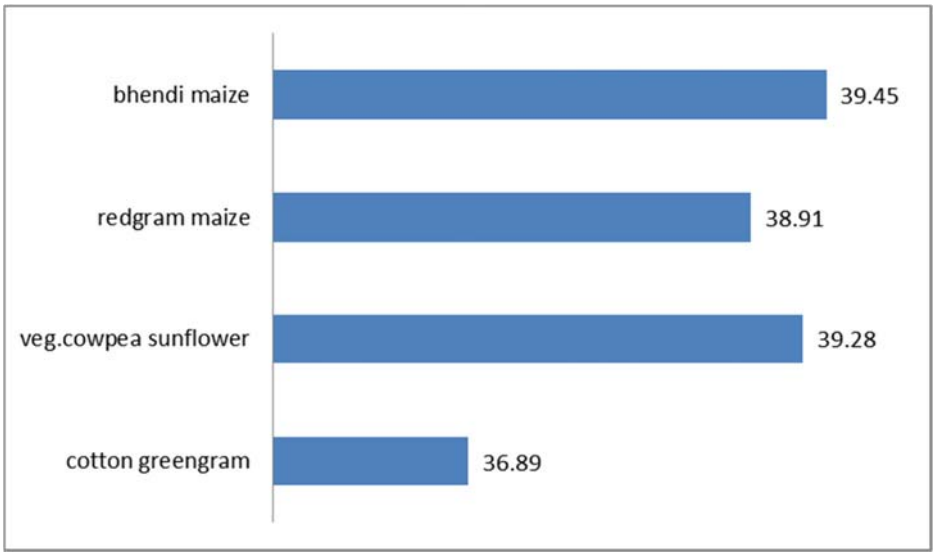


Total carbon removal (kg/ha) by the different cropping sequences

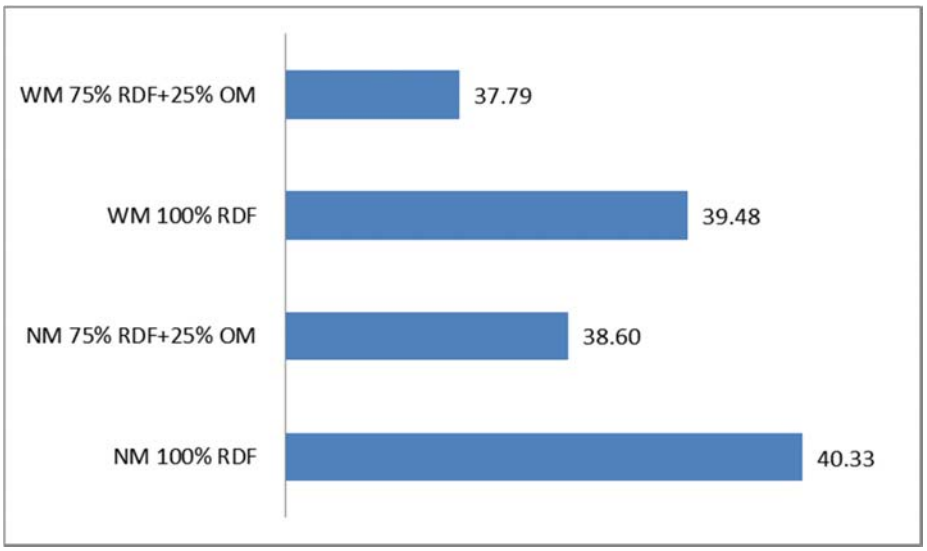


Total carbon removal (kg/ha) by the different tillage practices

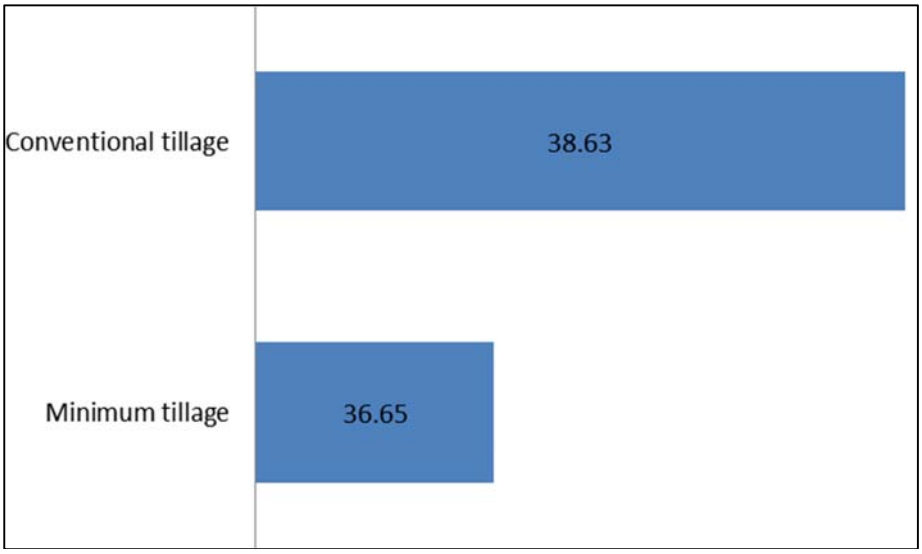
Fig 3: Total carbon removal as influenced by different factors



Soil temperature influenced by different cropping sequences

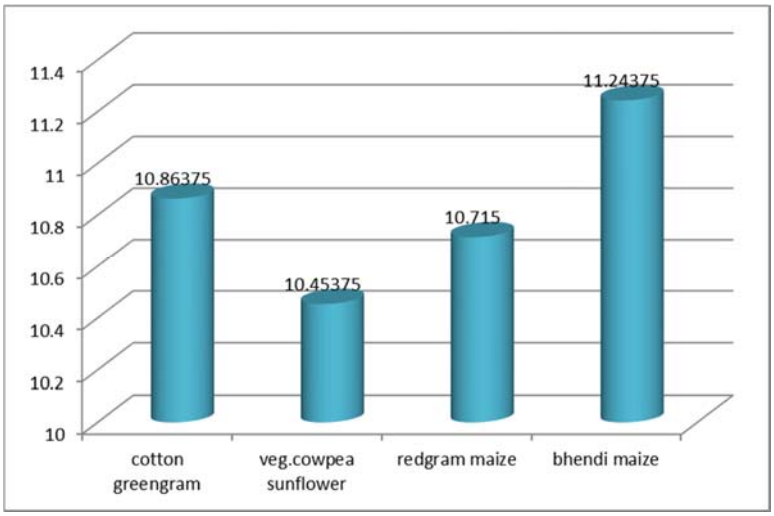


Soil temperature influenced by different nutrient practices

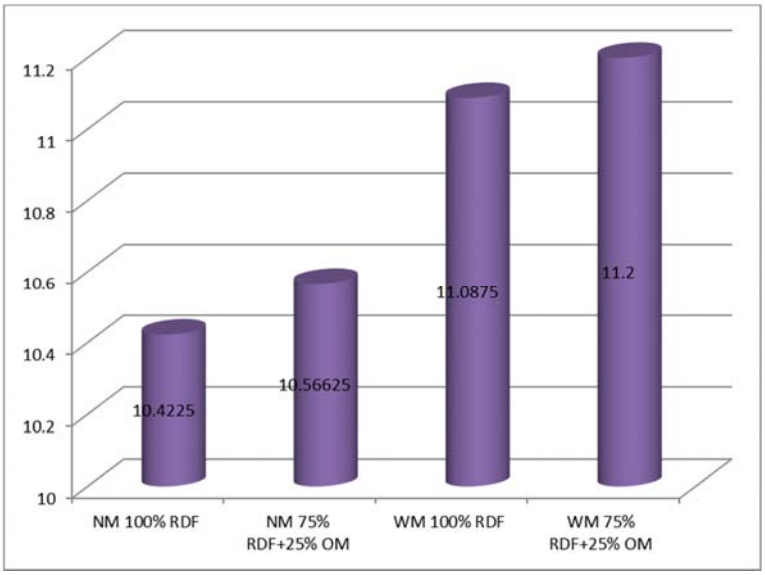


Soil temperature influenced by different tillage practices

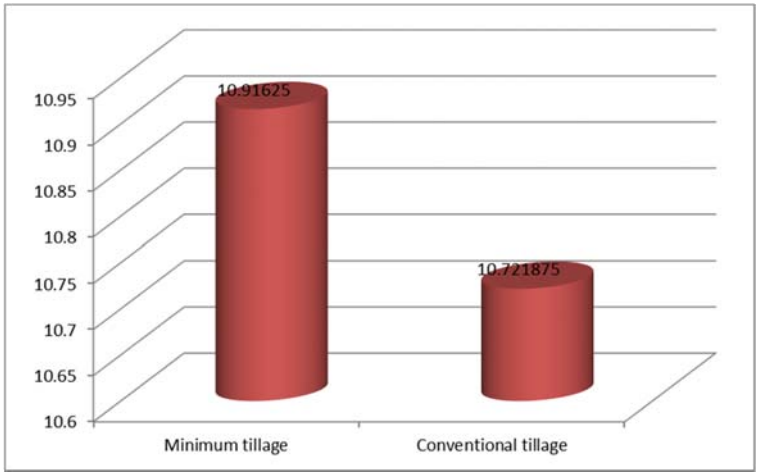
Fig 4: Soil temperature as influenced by different factors



Soil carbon stock aas influenced by different cropping sequences



Soil carbon stock aas influenced by nutrient practices



Soil carbon stock aas influenced by tillage practices

Fig 5: Soil carbon stock as influenced by different factors

Conclusion

Among four cropping sequences, bhendi - maize cropping sequence can yield maximum cotton equivalent yield. Irrespective of cropping sequence high cotton equivalent yield possible with mulching with 75% recommended dose of fertilizer + 25% N through organics for all crops under

conventional tillage. Sequence as a whole, high total carbon removal could be possible with bhendi - maize sequence and higher carbon stock can be achieved in the bhendi - maize cropping sequence under minimum tillage with mulch + 75% recommended dose of fertilizer + 25% through organics. The above favourable result supported with lower temperature and higher crop residue addition in the high yielding treatment. Maximum net return and benefit cost ratio could be with Bhendi - maize cropping sequence.

The information derived from the present study is, minimum tillage with 75% recommended dose of fertilizer + 25% through organics with mulching is suitable for majority of the crops, to mitigate the effects of climate change. Bhendi - maize cropping sequence is found to be sequestering more carbon in the soil as well as fix more carbon in biomass from the atmosphere through photosynthesis. Among the tillage practices, minimum tillage is recommended for environmental point of view.

References

1. Aulakh SM, Khera TS, Doran JW, Singh K, Singh B. Yields and nitrogen dynamics in a rice-wheat system using green manure and inorganic fertilizer. Soil Sci. Soc. Am. J. 2000; 4:1867-1876.
2. Chaudhry MR, Malik AA, Sidhu M. Mulching impact on moisture conservation-soil properties and plant growth. Pakistan Journal of Water Resources. 2004; 8(2):1-8.
3. FAO. The State of food and agriculture. Women in agriculture. Closing the gender gap for development. Rome: Food and Agriculture Organisation of the United Nations.Int. J. Agric. Bio. 2011; 11(2):119-124.
4. Khaliq T, Mahmood T, Kamal J, Masood A. Effectiveness of farmyard manure, poultry manure and nitrogen for corn (Zea mays L.) productivity. Int. J. Agri. Biol. 2007; 6(2):260-263.
5. Khurshid K, Iqbal M, Arif MS, Nawaz A. Effects of tillage and mulch on soil physical properties and growth of maize. Int. J. Agric. Biol. 2006; 8:593-596.
6. Natural Resources Conservation Service. Soil quality. NRCS: RCA Issue Brief 5 US Department of Agriculture, Washington Patton, M. Q. 1990. Qualitative Evaluation and Research Methods. Nebur Park, CA: Sage Publications. 1995.
7. Nill D, Nill E. The efficient use of mulch layers to reduce runoff and soil loss. In: K. Mulongoy and R. Merckx (Eds.) Soil organic matter dynamics and sustainability of tropical agriculture. John Wiley & Sons, Chichester - New York – Brisbane – Toronto - Singapore, 1993.
8. Page AL, Miller LB, Keeney DR. Methods *and* soil analysis. No. 9, Avon Series ASA-SSSA Publisher, Madison. Wisconsin, USA. 1982.
9. Pervez MA, Iqbal M, Shahzad K, Hassan A. Effect of mulch on soil physical Properties and N, P, K concentration in maize (Zea mays L.) shoots under two tillage systems, 2009.
10. Reddy GR, Malewar GU, Karle BG. Effect of crop residue incorporation and tillage operations on soil properties of Vertisol under rainfed agriculture. Indian J. Dryland. 2002.
11. Tolk JA, Howell TA, Evett SR. Effect of mulch, irrigation, and soil type on water use and yield of maize. Soil Tillage Res. 1999; 50(2):137-147.
12. Vetsch JA, Randall GW. Corn production as affected by tillage systems and starter fertilizer. Agron. J. 2002; 96:502-509.
13. Walkley A, Black CA. An examination of the Digtjareff method for determination of soil organic matter and a proposed modification of chornic acid titration method. Soil Sci. 1934; 37:29-39.