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Soil carbon fractions as influenced by pre and post emergence herbicide in sweet corn grown in vertisols

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Abstract
Field experiment was conducted at Department of Agronomy, College of Agriculture, Dhule during *Kharif* 2019 to study the effect of pre and post emergence herbicides *viz*., atrazine, halosulfuron methyl, 2-4-D ethyl ester, pendimethalin and tembotrione on soil carbon fractions in sweet corn. All the treatments of pre and post emergence herbicide application were statistically at par in respect of organic carbon fractions *viz.*, total organic carbon, Walkley-black carbon, water soluble carbon, soil microbial biomass carbon, permanganate oxidizable carbon, particulate organic matter carbon and humic acid and fulvic acid at harvest of sweet corn. The total organic carbon, Walkley-Black carbon, water soluble carbon, soil microbial biomass carbon, permanganate oxidisable soil carbon, particulate organic matter carbon, humic acid and fulvic acid was decreased by 9.86 to 10.90%, 17.62 to 18.15%, 12.02 to 12.32%, 13.15 to 14%, 9.57 to 9.94%, 30.23 to 30.93%, 25.30 to 26.74% and 26.64 to 28.15% in the treatments of pre and post emergence herbicides (T_3 to T_{10}) over the initial values of 104.2 g kg^{-1}, 5884 mg kg^{-1}, 82 mg kg^{-1}, 130 mg kg^{-1}, 138 mg kg^{-1}, 668 mg kg^{-1}, 13.91%m and 7.28%, respectively. The per cent decrease over initial value in organic fractions in the herbicide treatments at harvest of sweet corn was comparatively less as compared to the treatment of weed free check (T_2).

Keywords: Walkley-black carbon, water soluble carbon, soil microbial biomass carbon, permanganate oxidisable carbon, particulate organic matter carbon, humic acid and fulvic acid

Introduction
Soil organic carbon is of paramount importance for sustaining soil quality and long-term productivity of agricultural systems, measurements of changes in soil organic carbon under various nutrient management practices in intensive cropping system are the need of the day. Practices such as the addition of organic manures and/or residues, green manuring, inter-cropping with pulses, *etc* improve the content of soil organic carbon. The organic matter added to soil is subjected to microbial decomposition and intensity of decomposition is a function of soil moisture, temperature, and kind of organic input. Biological properties are critically important to the ecosystem functioning since they are involved in soil organic matter decomposition, nutrient cycling, and degradation of pesticides, such as herbicides (Araujo *et al.* 2003) [2]. Soil microbial biomass represents the active part of soil organic matter and is involved in several functions in soil, presenting a rapid turnover of soil C, N, and P; while enzymes are a suitable indicator of the catabolic activity of soil microorganism (Nannipieri and Badalucco 2003) [8].

Use of herbicides is a better supplement to conventional methods of weed control and forms an integral part of the modern crop production. It is evident that most of these herbicides may cause the reduction of sensitive populations of certain groups of biota in soil medium. It is believed that in cases where these herbicides are used to treat soils, they are considered harmful to nematode, earthworms and other biological organisms. They suppress the biodiversity of soil microbes, hinder the decomposition of soil organic matter and altered plant biomass. They also obstruct the biological activities of soil biota, photosynthetic, biosynthetic reaction, cell growth / divisions and molecular composition of soil biota (Usman *et al.* 2017) [14].

Though lot of information is available concerning the influence of herbicide on soil micro flora and fauna, very little information is available concerning their effects on soil organic carbon fractions. Keeping these fact in view, the present investigation was undertaken to study "Soil carbon fractions as influenced by pre and post emergence herbicide in sweet corn grown in Vertisols''

Material and Methods

Field experiment was conducted at Department of Agronomy, College of Agriculture, Dhule during *Kharif* 2019 to study the effect of pre and post emergence herbicides on soil enzymes in sweet corn. The experiment was laid out in randomized block design with ten treatments replicated three times. Treatments composed of T_1: weedy check, T_2: weed free (two hand weeding), T_3: atrazine @ 1000 g ha^{-1} (PE) *fb* halosulfuron methyl @ 90 g ha^{-1} (PoE), T_4: atrazine @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), T_5: pendimethalin @ 1000 g ha^{-1} (PE) *fb* halosulfuron-methyl @ 90 g ha^{-1} (PoE), T_6: pendimethalin @ 1000 g ha^{-1} (PE) *fb* tembotrione @ 120 g ha^{-1} (PoE), T_7: pendimethalin @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), T_8: halosulfuron-methyl @ 90 g ha^{-1} (PoE), T_9: tembotrione @ 120 g ha^{-1} (PoE) and T_{10}: 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE). The pre emergence (PE) herbicides were applied on next day after sowing of sweet corn, however, the post emergence (PoE) hebicides were applied 30 days after sowing of sweet corn.

The soil of experimental site was medium black with the following chemical properties: pH 8.01, electrical conductivity (EC) 0.32 dS m^{-1}, organic carbon (5.60 g kg^{-1}), calcium carbonate (49 g kg^{-1}), available N (202.34 kg ha^{-1}), available (Olsen-P) P (17.32 kg ha^{-1}), available (NH_4OAc-K) K (402.25 kg ha^{-1}), total organic carbon (104.2 g kg^{-1}), Walkley - Black soil organic carbon (5884 mg kg^{-1}), water soluble carbon (82 mg kg^{-1}), soil microbial biomass carbon (130 mg kg^{-1}), permanganate oxidisable soil carbon (138 mg kg^{-1}), particulate organic matter carbon (668 mg kg^{-1}), humic acid (13.91%) and fulvic acid (7.28%).

Representative moistened soil samples were collected from each plot before sowing and at harvest. Total organic carbon was determined by dry ashing method and Walkley - Black soil organic carbon was determined by wet oxidation method (Nelson and Sommer 1982) [9]. Water soluble carbon was determined by water extraction method method (Mc Gill *et al.* 1986) [7]. Soil microbial biomass carbon was determined by chloroform fumigation extraction method (Vance *et al.* 1987) [15]. Permanganate oxidisable soil carbon was determined by permanganate oxidation method method (Blair *et al.* 1995) [3]. Particulate organic matter carbon was determined by wet sieving method method (Cambardella and Elliott 1992) [4]. Humic and Fulvic acid were determined by 0.5 *N* NaOH extractant method (Stevenson 1994) [13].

Result and Discussion

Total organic carbon (TOC)

The total organic carbon as influenced by application of pre and post emergence herbicides *viz*., atrazine, halosulfuron methyl, 2-4-D ethyl ester, pendimethalin and tembotrione at harvest are reported in Table 1. The treatment of weedy check (T_1) recorded significantly higher total organic carbon 99.47 g kg^{-1} at harvest of sweet corn. However, in T_1 treatment total organic carbon was decreased by 4.53% over initial value of 104.2 g kg^{-1}. The weed free treatment (two hand weeding) recorded significantly lower total organic carbon 89.87 g kg^{-1}. In T_2 treatment total organic carbon was decreased by 13.57% over initial value. The treatment T_2 was statistically at par with the treatments, atrazine @ 1000 g ha^{-1} (PE) *fb* halosulfuron methyl @ 90 g ha^{-1} (PoE), atrazine @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* halosulfuron-methyl @ 90 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* tembotrione @ 120 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* 2,4-D ethyl ester @ 1000 g ha^{-1} (PoE), halosulfuron-methyl @ 90 g ha^{-1} (PoE), tembotrione @ 120 g ha^{-1} (PoE) and 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE). The total organic carbon content was decreased by 9.86 to 10.90% in the treatments of pre and post emergence herbicides (T_3 to T_{10}) over the initial value of 104.2 g kg^{-1}. Abbas *et al*. (2014) [1] also reported that long-term application of this buctril super (bromoxynil) herbicide in wheat fields reduced total organic carbon (TOC) up to 28.57%.

Walkley - Black carbon

The Walkley-Black Soil organic carbon was significantly higher (5713 mg kg^{-1}) in the treatment of weedy check (T_1) at harvest of sweet corn (Table 1). This treatment was followed by the treatment of pendimethalin @ 1000 g ha^{-1} (PE) *fb* tembotrione @ 120 g ha^{-1} (PoE), which recorded the Walkley-Black carbon 4847 mg kg^{-1}. However, this treatment was statistically at par with the treatment of atrazine @ 1000 g ha^{-1} (PE) *fb* halosulfuron methyl @ 90 g ha^{-1} (PoE), atrazine @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* halosulfuron-methyl @ 90 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), halosulfuron-methyl @ 90 g ha^{-1} (PoE), tembotrione @ 120 g ha^{-1} (PoE) and 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE). The weed free treatment (two hand weeding) recorded significantly lower Walkley-Black carbon 4617 mg kg^{-1}. The Walkley-Black carbon content was decreased by 2.90%, 17.62 to 18.15% and 21.53% in the treatments of weedy check (T_1), treatments of pre and post emergence herbicides (T_3 to T_{10}) and weed free treatment (two hand weeding) treatment, respectively over the initial value of 5884 mg kg^{-1}.

Water soluble carbon (WSC)

The treatment of weedy check (T_1) recorded significantly higher water soluble carbon (79.82 mg kg^{-1}) at harvest of sweet corn with the decrease of 2.65% over the initial value of 82 mg kg^{-1} (Table 2). This treatment was followed by the application of 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), which recorded the water soluble carbon 72.14 mg kg^{-1}. However, this treatment was statistically at par with the treatment of atrazine @ 1000 g ha^{-1} (PE) *fb* halosulfuron methyl @ 90 g ha^{-1} (PoE), atrazine @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* halosulfuron-methyl @ 90 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* tembotrione @ 120 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), halosulfuron-methyl @ 90 g ha^{-1} (PoE) and tembotrione @ 120 g ha^{-1} (PoE). The water soluble carbon content was decreased 12.02 to 12.32% in the treatments of pre and post emergence herbicides (T_3 to T_{10}) over the initial value of 82 mg kg^{-1}. The weed free treatment (two hand weeding) recorded significantly lower water soluble carbon 68.73 mg kg^{-1} with the decrease of 16.18% over the initial value of 82 mg kg^{-1}.

Soil microbial biomass carbon (SMBC)

The soil microbial biomass carbon was significantly higher (118.2 mg kg^{-1}) in the treatment of weedy check (T_1) at harvest of sweet corn (Table 2). This treatment was followed by the application of tembotrione @ 120 g ha^{-1} (PoE) which recorded the soil microbial biomass carbon 112.9 mg kg^{-1}. However, this treatment was statistically at par with the treatment of atrazine @ 1000 g ha^{-1} (PE) *fb* halosulfuron methyl @ 90 g ha^{-1} (PoE), atrazine @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* halosulfuron-methyl @ 90 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* tembotrione @ 120 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), halosulfuron-methyl @ 90 g ha^{-1} (PoE) and 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE). The weed free treatment (two hand weeding) recorded significantly lower soil microbial biomass carbon 109.7 mg kg^{-1}.

The soil microbial biomass carbon content decreased by 9.07%, 13.15 to 14% and 15.61% in the treatments of weedy check (T_1), treatments of pre and post emergence herbicides (T_3 to T_{10}) and weed free treatment (two hand weeding) treatment, respectively over the initial value of 130 mg kg^{-1}. Reduction in soil microbial biomass carbon due to application of pre- and post-emergence herbicides was reported by many workers (Perucci *et al.* 1992, Perucci and Scarponi 1996, EL-Ghamry *et al.* 2000, Mayeetreyee *et al.* 2013 and Pertile *et al.* 2020) [12, 11, 5, 6, 10].

Permanganate oxidisable carbon (POC)

The permanganate oxidisable soil carbon was significantly higher (129.77 mg kg^{-1}) in the treatment of weedy check (T_1) at harvest of sweet corn with the decrease of 5.96% over the initial value of 138 mg kg^{-1} (Table 3). This treatment was followed by the application of atrazine @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), which recorded the permanganate oxidisable soil carbon 124.79 mg kg^{-1}. However, this treatment was statistically at par with the treatment of atrazine @ 1000 g ha^{-1} (PE) *fb* halosulfuron methyl @ 90 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* halosulfuron-methyl @ 90 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* tembotrione @ 120 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), halosulfuron-methyl @ 90 g ha^{-1} (PoE), tembotrione @ 120 g ha^{-1} (PoE) and 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE). The permanganate oxidisable soil carbon was decreased 9.57 to 9.94% in the treatments of pre and post emergence herbicides (T_3 to T_{10}) over the initial value of 138 mg kg^{-1}. The weed free treatment (two hand weeding) recorded significantly lower permanganate oxidisable soil carbon 119.91 mg kg^{-1} with the decrease of 13.10% over the initial value of 138 mg kg^{-1}.

Particulate organic matter carbon (POMC)

The treatment of weedy check (T_1) recorded significantly higher particulate organic matter carbon 546.33 mg kg^{-1} at harvest of sweet corn (Table 3). However, in T_1 treatment particulate organic matter carbon was decreased by 18.21% over initial value of 668 mg kg^{-1}. The weed free treatment (two hand weeding) recorded significantly lower particulate organic matter carbon 442.33 mg kg^{-1}. In T_2 treatment particulate organic matter carbon was decreased by 33.78% over initial value. The treatment T_2 was statistically at par with the treatments, atrazine @ 1000 g ha^{-1} (PE) *fb* halosulfuron methyl @ 90 g ha^{-1} (PoE), atrazine @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* halosulfuron-methyl @ 90 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* tembotrione @ 120 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), halosulfuron-methyl @ 90 g ha^{-1} (PoE), tembotrione @ 120 g ha^{-1} (PoE) and 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE). The particulate organic matter carbon was decreased by 30.23 to 30.93% in the treatments of pre and post emergence herbicides (T_3 to T_{10}) over the initial value of 668 mg kg^{-1}.

Humic acid

The humic acid was significantly higher (12.84%) in the treatment of weedy check (T_1) at harvest of sweet corn (Table 4). Application of halosulfuron-methyl @ 90 g ha^{-1} (PoE) recorded significantly lower humic acid 10.19%. However, the treatment T_8 was statistically at par with the treatments, weed free treatment (two hand weeding), atrazine @ 1000 g ha^{-1} (PE) *fb* halosulfuron methyl @ 90 g ha^{-1} (PoE), atrazine @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* halosulfuron-methyl @ 90 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* tembotrione @ 120 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), tembotrione @ 120 g ha^{-1} (PoE) and 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE).

The humic acid was decreased by 7.69% over initial value of 13.91% in the treatment of weedy check (T_1). In the weed free treatment (two hand weeding), the humic acid was decreased by 25.73% over initial value. However, in the treatments of pre and post emergence herbicides (T_3 to T_{10}), the humic acid was decreased by 25.30 to 26.74% over the initial value of 13.91%.

Fulvic acid

The treatment of weedy check (T_1) recorded significantly higher fulvic acid (6.58%) at harvest of sweet corn with the decrease of 9.61% over the initial value of 7.28% (Table 4). This treatment was followed by the treatment 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), which recorded the fulvic acid 6.34%. The fulvic acid was decreased by 12.91% in the treatment T_{10} over initial value. The weed free treatment (two hand weeding) recorded significantly lower fulvic acid 5.12% with the decrease of 29.67% over the initial value of 7.28%. The weed free treatment (two hand weeding) was statistically at par with the treatment of atrazine @ 1000 g ha^{-1} (PE) *fb* halosulfuron methyl @ 90 g ha^{-1} (PoE), atrazine @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* halosulfuron-methyl @ 90 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* tembotrione @ 120 g ha^{-1} (PoE), pendimethalin @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE), halosulfuron-methyl @ 90 g ha^{-1} (PoE) and tembotrione @ 120 g ha^{-1} (PoE).

Table 1: Total and Walkley-Black soil organic carbon as influenced by application of herbicides for sweet corn

Sr. No.	Treatments	Total organic carbon (g kg^{-1})	Walkley – Black Soil organic carbon (mg kg^{-1})
1.	Weedy	99.47^{a}	5713^{a}
2.	Weed free (two hand weedings)	89.87^{b}	4617^{c}
3.	Atrazine @ 1000 g ha^{-1} (PE) *fb* halosulfuron methyl @ 90 g ha^{-1} (PoE)	93.29^{b}	4843^{b}
4.	Atrazine @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE)	92.82^{b}	4816^{b}
5.	Pendimethalin @ 1000 g ha^{-1} (PE) *fb* halosulfuron-methyl @ 90 g ha^{-1} (PoE)	92.84^{b}	4843^{b}
6.	Pendimethalin @ 1000 g ha^{-1} (PE) *fb* tembotrione @ 120 g ha^{-1} (PoE)	93.40^{b}	4847^{b}
7.	Pendimethalin @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE)	92.89^{b}	4833^{b}
8.	Halosulfuron-methyl @ 90 g ha^{-1} (PoE)	93.14^{b}	4817^{b}
9.	Tembotrione @ 120 g ha^{-1} (PoE)	93.47^{b}	4824^{b}
10.	2,4 D ethyl ester @ 1000 g ha^{-1} (PoE)	93.19^{b}	4828^{b}
	SE(m)$\pm$	1.39	49
	CD at 5%	4.15	152

Table 2: Active carbon pools as influenced by application of herbicides for sweet corn

Sr. No.	Treatments	Water soluble carbon (mg kg^{-1})	Soil microbial biomass carbon (mg kg^{-1})
1.	Weedy	79.82^{a}	118.2^{a}
2.	Weed free (two hand weedings)	68.73^{c}	109.7^{c}
3.	Atrazine @ 1000 g ha^{-1} (PE) *fb* halosulfuron methyl @ 90 g ha^{-1} (PoE)	71.89^{b}	112.2^{b}
4.	Atrazine @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE)	72.09^{b}	112.0^{b}
5.	Pendimethalin @ 1000 g ha^{-1} (PE) *fb* halosulfuron-methyl @ 90 g ha^{-1} (PoE)	72.11^{b}	112.2^{b}
6.	Pendimethalin @ 1000 g ha^{-1} (PE) *fb* tembotrione @ 120 g ha^{-1} (PoE)	71.91^{b}	111.9^{b}
7.	Pendimethalin @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE)	71.91^{b}	112.4^{b}
8.	Halosulfuron-methyl @ 90 g ha^{-1} (PoE)	71.98^{b}	111.8^{b}
9.	Tembotrione @ 120 g ha^{-1} (PoE)	72.13^{b}	112.9^{b}
10.	2,4 D ethyl ester @ 1000 g ha^{-1} (PoE)	72.14^{b}	112.3^{b}
	SE(m)$\pm$	0.71	0.78
	CD at 5%	2.14	2.32

Table 3: Labile and intermediate carbon pools as influenced by application of herbicides for sweet corn

Sr. No.	Treatments	Permanganate oxidisable soil carbon (mg kg^{-1})	Particulate organic matter carbon (mg kg^{-1})
1.	Weedy	129.77^{a}	546.33^{a}
2.	Weed free (two hand weedings)	119.91^{c}	442.33^{b}
3.	Atrazine @ 1000 g ha^{-1} (PE) *fb* halosulfuron methyl @ 90 g ha^{-1} (PoE)	124.57^{b}	461.33^{b}
4.	Atrazine @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE)	124.79^{b}	465.67^{b}
5.	Pendimethalin @ 1000 g ha^{-1} (PE) *fb* halosulfuron-methyl @ 90 g ha^{-1} (PoE)	124.31^{b}	463.33^{b}
6.	Pendimethalin @ 1000 g ha^{-1} (PE) *fb* tembotrione @ 120 g ha^{-1} (PoE)	124.32^{b}	463.67^{b}
7.	Pendimethalin @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE)	124.78^{b}	466.00^{b}
8.	Halosulfuron-methyl @ 90 g ha^{-1} (PoE)	124.27^{b}	462.67^{b}
9.	Tembotrione @ 120 g ha^{-1} (PoE)	124.61^{b}	465.33^{b}
10.	2,4 D ethyl ester @ 1000 g ha^{-1} (PoE)	124.36^{b}	464.33^{b}
	SE(m)$\pm$	0.96	9.06
	CD at 5%	2.88	27.21

Table 4: Passive carbon pools as influenced by application of herbicides for sweet corn

Sr. No.	Treatments	Humic acid (%)	Fulvic acid (%)
1.	Weedy	12.84^{a}	6.58^{a}
2.	Weed free (two hand weedings)	10.33^{b}	5.12^{c}
3.	Atrazine @ 1000 g ha^{-1} (PE) *fb* halosulfuron methyl @ 90 g ha^{-1} (PoE)	10.39^{b}	5.32^{c}
4.	Atrazine @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE)	10.30^{b}	5.30^{c}
5.	Pendimethalin @ 1000 g ha^{-1} (PE) *fb* halosulfuron-methyl @ 90 g ha^{-1} (PoE)	10.30^{b}	5.33^{c}
6.	Pendimethalin @ 1000 g ha^{-1} (PE) *fb* tembotrione @ 120 g ha^{-1} (PoE)	10.37^{b}	5.26^{c}
7.	Pendimethalin @ 1000 g ha^{-1} (PE) *fb* 2,4 D ethyl ester @ 1000 g ha^{-1} (PoE)	10.21^{b}	5.28^{c}
8.	Halosulfuron-methyl @ 90 g ha^{-1} (PoE)	10.19^{b}	5.23^{c}
9.	Tembotrione @ 120 g ha^{-1} (PoE)	10.28^{b}	5.33^{c}
10.	2,4 D ethyl ester @ 1000 g ha^{-1} (PoE)	10.23^{b}	6.34^{b}
	SE(m)$\pm$	0.19	0.12
	CD at 5%	0.62	0.38

Conclusion

All the treatments of pre and post emergence herbicide application were statistically at par in respect of organic carbon fractions *viz.*, total organic carbon, Walkley-black carbon, water soluble carbon, soil microbial biomass carbon, permanganate oxidizable carbon, particulate organic matter carbon and humic acid and fulvic acid at harvest of sweet corn. The per cent decrease over initial value in organic fractions in the herbicide treatments at harvest of sweet corn was comparatively less as compared to the treatment of weed free check (T_2).

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