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Response of soil–surface arthropod population densities across the 15 different soil management treatments

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ABSTRACT

In India, there have been very few studies to quantify the effects of soil macrofauna activity in farmland, and on the effects of farm practices on the structure and function of soil arthropod populations. Thus, the present investigation was undertaken and efforts were made to assess the response of soil–surface arthropod population densities across 15 different soil management treatments. The relative population density of soil–surface inhabiting arthropods were monitored using pitfall traps. Pitfall traps have been used often in studies examining the occurrence and activity of epigeic–invertebrates. These arthropods were sampled in each plot every month during three seasons, i.e., rainy (June to September,) post rainy (October to January) and summer (February to May) seasons. Each pitfall trap consisted of a glass jar (12 cm high with a diameter of 5 cm at the mouth), which was sunk into the ground so that its upper rim (mouth of the bottle) was flushed with the soil surface. The mean density of total arthropods were significantly low in annual treatments compared with those of the perennial ley treatments. Under the annual crop, in zero–tillage treatments, the density was low in bare amendment while it was high in rice-straw amendment. In shallow–tillage treatments, it was lower in rice–straw amendment and increased to 22 in bare amendment, In deep–tillage treatments, it was low in bare amendment, which increased to 28 in farmyard manure amendment. In perennial ley treatments, the density was low in C. ciliaris + S. hamata treatment, which reached 35 in pigeon pea + S. hamata treatment.

Introduction

The soil surface covers one third of our planet and shows a great variety of physic-chemical and biological characteristics, which influence on another. The a biotic characteristics, Particularly the climatic ones, change rapidly and induce changes in the biotic communities ; thus, the individuals of the biotic communities react to the extremes of a biotic conditions either by falling into resting stage or by moving towards places where favourable conditions exist.

Soil macrofauna constitute a major component of the biotic communities inhabiting the soil surface which includes both phytophagous and predatory species. The activities of soil macrofauna are important in maintaining soil structure and regulating the physico-chemical properties of the soil (Hole,

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1980; Lal, 1988; Lee and Foster, 1991), which contribute to the stability of the soil resource. However, there have been a few studies that have quantified the effects of soil macrofaunal activity in arable soils (Abbott et al, 1979; Abbott and Parker, 1980), particularly in tropical countries. They possibly influence the availability of nutrients for plants (Weidemann, 1978). Besides, they help in soil aeration, turnover, and infiltration (Hole, 1980). They contribute to the breakdown, decomposition and mineralization of organic matter in soil (Neumann, 1973; Springett, 1978; Coleman et al. 1984; Seastedt. 1984).

Soil management practices such as tillage cause several changes in the properties of soils, including increased rates of plant residue decomposition. It alters the soil faunal communities (Andren and Lagerlof, 1983; Edwards, 1983 ;) Hendrix et al, 1986; Ryszkowasiki, 1985). Periodic soil tillage, which tends to minimize water and nutrient competition between cultivated plants and weeds in orchards, is one of the most ancient soil management methods. When the plant cover is removed, the bare soil is subject to degradation of its soil structure leading to soil erosion, and reduction in soil biota (Seastedt, 1984; Dindal, 1990).

Michalak (1984) compared the collembola associated with organic and conventional agroecosystems. Lagerlof and Andren (1988) studied the abundance and activity of soil mites in four cropping systems. Perdue and Crossley (1989) examined the seasonal fluctuations of soil mite abundance in conventional and no–tillage experimental agroecosystems. Lagerlof and Andren (1990) studied the abundance and activity of collembola under four arable crops. Unfortunately, in India, there have been very few studies to quantify the effects of soil macrofauna activity in farmland, and on the effects of farm practices on the structure and function of soil arthropod populations (Reddy,1984). Thus, the present investigation was undertaken and efforts were made to assess the response of soil–surface arthropod population structure to 15 different soil management practices across rainy, postrainy and dry seasons in an Alfisol maize agroecosystem.

MATERIALS AND METHODS

The relative population density of soil–surface inhabitinig arthropods were monitored using pitfall traps. Pitfall traps have been used often in studies examining the occurrence and activity of epigaeic–invertebrates (Southwood, 1978). The details of the method are given in Southwood (1978) and Reddy and Venkataiah (1986). These arthropods were sampled in each plot every month during three seasons, i.e., rainy (June to September,) post rainy (October to January) and summer (February to May) seasons. Each pitfall trap consisted of a glass jar (12 cm high with a diameter of 5 cm at the mouth), which was sunk into the ground so that its upper rim (mouth of the bottle) was flushed with the soil surface. The jar was covered with a plastic plate (9 x 9 cm) to stop rain and dust from entering the traps. The space between the plate and soil surface was at least 3 cm. The jars contained about 100 ml ethylene glycol solution to kill and preserve the trapped arthropods. These trape were established by using a cylindrical soil core sampler. While installing the traps, care was taken not to disturb the immediate surrounding of the trap. One trap was place in the middle of each plot. The total trapping period was 24 hours (1 day), after which the traps were removed gently, tightly capped, labelled and brought to the laboratory, Each jar was emptied in a petri dish and examined under a stereoscopic binocular microscope (Wild Heerbrug) and classified into different taxa of arhtorpods. Differences in relative population densities of the soil–Surface arthropods across the treatments were analysed by ANOVA by using GENSTAT.

The experimental design :

The experimental design was an incomplete randomised block design with an embedded factorial (Murari Singh, personal communication, 1987).There were three tillage treatments and three organic amendment treatments (Cropped annually) in the factorial plus an additional six perennial species treatments (with no annual tillage or mulching) (Table 1). There were three replicates of each of the 15 treatments. The layout of the 15 treatments is shown in fig. 5 Analysis of variance was carried out within the factorial, to show the effects of tillage depth and mulch or within the randomised block to compare all treatments. Plots were 5 m wide by

28.5 m long and 1.5 m apart. They were enclosed by a sheet metal strip embedded 10 cm into, and projecting 10 cm above the soil to define the catchment area.

Treatments:

Tillage :

Tillage depths were 0, 10 and 20 cm (referred to as T0, T10, and T20, respectively) (Table 1). Tillage was imposed after initial rains in early June. Tilled plots initially received a shallow tine with duck foot tillage (0.05-0.07 m depth) to break the surface crust and to control weeds. After further rains, typically 10-14 days, a second tillage was imposed using narrow tines and 50 cm spacing to the treatment depth. Tines were chosen for tillage because they caused soil disturbance similar to that of the wooden country plough used by Indian farmers. Tines were mounted on a tractor-drawn tool bar and T10 and T20 plots were subjected to one pass with the depth set at 10 cm. Chisel tines, 4 cm wide and spaced 60 cm apart, were passed once through T20 plots after the shallow tillage operation, These chisel tines had been used earlier at ICRISAT in tillage studies with bullock-drawn equipment. Hence, although a tractor was used, the soil disturbance during deep tillage was consisted with that resulting from using animal traction power (Smith et al, 1992).

Organic amendments :

The mulch treatments were applied [(15t ha-1 farmyard manure (FYM), 5 t ha-1 rice–straw Oryza sativa L)] in three equal increments after each of these cultural operations (Table 1) (Smith et al, 1992). Rice- straw was removed to facilitate tillage and then replaced. It was cut at ground level and carried from a nearby field and used because it provides a high surface area per unit weight and, compared to maize straw, it was not as much in demand for other uses. Moreover rice-straw increased soil fauna activities in an alfisol in Nigeria when applied as a mulch at 6 and 10 t ha-1 (Lal et al. 1980). Farmyard manure (FYM) was applied at a relatively high rate of 15 t ha-1 because 5 t ha-1 applied over 8 years had no visible effect on soil structure on a similar soil (K.L. Sahrawat, personal communication, 1987). No mulch materials were applied to the perennial ley treatments. The mulch treatments were applied within 10 days after sowing as surface cover between the rows of emerging seedlings in the tillage treatments. The materials were not mechanically incorporated into the soil. This was to ensure that the soil surface was protected from temperature extremes, from raindrop impact and to provide a suitable habitat for soil fauna.

Cover crops (Perennials) :

Perennial species selected in the present experiment alone and in combination (Table 1) were perennial pigeonpea (Cajanus cajan (L) Millsp), verano stylo (Stylosanthes hamata (L)) (TAUBERT) and buffel grass (Cenchrus ciliaris (L)) (Smith et al, 1992). Perennial pigeonpea was selected because of the beneficial effect of pigeonpea on the subsequent crop (Kumar Rao et al., 1983). Buffel grass and verano stylo were selected on the basis of their earlier good performance in observation trails at ICRISAT (M.M Sharma, personal communication, 1987) and on Alfisols in India (R.P Singh , and Y.P. Singh, personal communication , 1987). The effects of these species on soil structure were not known, but it was considered preferable to use the species that might be acceptable to farmers on the basis of productivity of high-quality fodder rather than those known for their effects on soil structure .Verano stylo fixes appreciable amounts of nitrogen and was the basis of ley pasture systems used in Alfisols in northern Australia (Cogle et al, 1991). Verano stylo and buffel grass have also some potential to improve soil structure in Alfisols in northern Australia (Bridge et al, 1983). Apart from the formation of sowing furrows, soil in these treatments was not tilled.

Sowing :

Maize (Pro-Ago-3448) was sown in mid- July after imposing the treatments in late June during 1996 and 1997 in the tillage depth x mulch type factorial. On 20 July 1996, seeds were sown by hand in rows 60 cm apart. Small sowing furrows were formed by drawing the chisel tines at a depth of 5 cm in all tillage treatments. In deep tillage plots, the maize rows were loacted over the path of the deep tillage tines. Buffel grass and varano stylo were sown in alternate rows 38 cm apart in mixed swards. Perennial pigeonpea (Cultivar ICPL 88040) was sown in rows 1 m apart, with plants within rows being 1.2 m apart. The seeds were covered with soil by hand raking. In July 1996, carbofuran insecticide granules (40 kg ha-1) were applied to the soil in the planting rows to control shoot fly (Atherigona soccata Rond). Again in July and August 1997, carbofuran granules (5 kg ha-1) were applied to the whorls of the maize seedlings for shoot fly control. Fertilizer applied was 100 kg ha-1 Diammonium phosphate at planting and 200 kg ha-1 urea by side dressing. Paraquat (1 kg a.i.ha-1) was applied to all plots on 29 June and 20 july 1996 and to no till mulch on 5 July 1997. The annual maize crop was harvested in November in 1996 and 1997. The S. hamta and C. ciliaris plots were harvested twice per year and the cut material were removed. The perennial pigeonpea was pruned in 1996 to control growth. In 1997. The perennial pigeonpeas were replanted because of wilt (Fusarium udum), termites (Odontotermes obesus (Rembur) and Microtermes obesi Holmgren) attack and drought (Reddy et al., 1992) Considerable leaf fail occurred from perennial pigeonpea, much of which was retained in the PP +S and PP + S + C plots, but it was blown away from PP plots which consequently have generally bare soil throughout the year. The S. hamata produced a thick cover up to 0.3 cm high during the rainy season, while C. ciliaris plots had complete projected foliage cover but grass tufts were separated by bare soil areas. C. ciliaris and S. hamata plants were trimmed early in the growing season and were then allowed to go to seed to thicken the stand. Pigeonpea yield was measured by picking pods and trimming plants 80 cm above the ground.

RESULTS

Total soil–surface arthropods :

The responses of the relative population densities of different groups of arthropods inhabiting the soil surface across the 15 different soil management treatments are presented in Fig. 1.The mean density of total arthropods were significantly low in annual treatments (15.5) compared with those of the perennial ley treatments (35) (Fig.1). Under the annual crop, in zero–tillage treatments, the density was low in bare amendment (16.2) while it was high in rice-straw amendment (28.9) In shallow–tillage treatments, it was lower in rice–straw amendment (18.1) and increased to 22 in bare amendment, In deep–tillage treatments, it was low in bare amendment (20), which increased to 28 in farmyard manure amendment. In perennial ley treatments, the density was low in C. ciliaris + S. hamata treatment (18.5), which reached 35 in pigeon pea + S. hamata treatment.

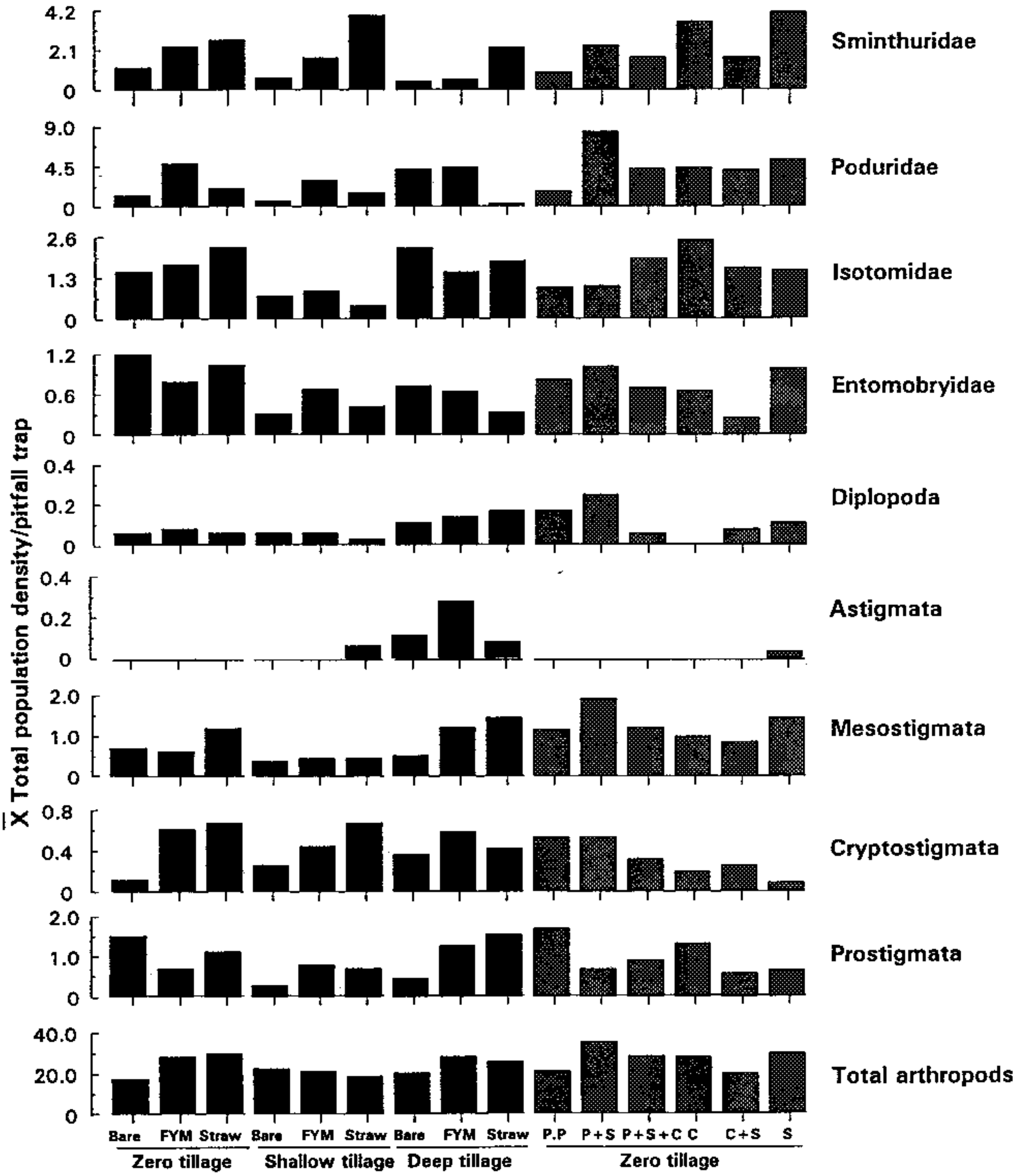
Entomobryidae:

Its relative population densities across the 15 soil management treatments presented in Fig.1 revealed that the mean population density was significantly low (0.24) in perennial ley treatments compared with those in the annual treatments (1.1). It indicated that they were too few to show any discernible variation across the annual and perennial treatments. The Entomobryidae densities did not differ significantly across the tillage and organic amendment treatments and perennial ley treatments and across all the 15 treatments (Tables 1) as revealed by the ANOVA. Besides, ANOVA of the monthly data also did not differ significantly across all the treatments, and the tillage and organic amendment treatments. However, ANOVA of the monthly data of perennial ley treatments showed that the densities differed significantly across the treatments during June 1997 (P< 0.05).

Isotomidae:

Its relative population densities across the 15 soil management treatments, presented in Fig.1 revealed that the population was low (0.3) in annual treatments compared with those of the perennial ley treatments (2.4). Under the annual crop, in zero–tillage treatments, the density was low (1.4) in bare amendment while it was high (2.2) in rice - straw amendment. In shallow-tillage treatments, its densities were < 1. In deep tillage treatments, the density was low in farmyard manure amendment (1.4) and increased to 2.23 in bare amendment. In perennial ley treatments, its density was low (< 1) in pigeonpea treatment, which increased to 2.4 in C. Ciliaris treatment. ANOVA showed that the densities of isotomidae were significantly different in the tillage and organic amendment treatments across seasons (P<0.01), tillage (P<0.05), season and tillage interaction (P<0.05). ANOVA of the monthly data showed that the densities were also different across the tillage during April, June, and October 1997 (P<0.05). Besides, the densities differed significantly across the perennial ley treatments during June 1997 (P< 0.01).

Figure-1. Relative population densities of the soil–surface arthoropods across 15 soil management treatments.



Poduridae:

Its relative population densities across the 15 soil management treatments presented in Fig. 21revealed that the mean density was significantly low (<1) in annual treatments compared with those of the perennial ley treatments (8.1).Under annual crop, in zero–and shallow tillage treatments, the density was low in bare amendment (1.23) and (0.61) which increased to 4.6 and 2.7 in farmyard manure

Table-1. Analysis of variance (mean squares) of the data on mean population densities of soil–surface arthropods across perennial ley treatments (numbers in parentheses represent degree of freedom).

Arthropod taxa	Source of variation				
	Seasons (S) (2)	Treatment (T) (5)	SxT (10)	Error (46)	Mean abundance
Araneae	33.13**	1.03	1.25	1.32	1.5
Prostigmata	17.85**	3.52**	4.01**	0.94	1.2
Cryptostigmata	0.72**	0.13	0.19	0.10	0.2
Mesostgmata	13.37**	0.09	0.66	0.34	0.7
Poduridae	149.24**	68.65	43.17	44.30	3.3
Sminthuridae	47.57**	2.79	6.87*	3.29	1.6
Coleoptera Larvae	0.39**	0.13	0.17**	0.06	0.1
Hymenoptera	3654.80*	776.01	1143.66	891.10	16
Dermaptera	4.69**	0.16	0.13	0.17	0.4
Orthoptera	2.35**	0.52	0.22	0.35	0.4
Hemiptea	0.7**	0.21	0.06	0.12	0.2
Homoptera	0.57**	0.33**	0.15	0.09	0.1
Lepidoptera larvae	0.55**	0.09	0.09	0.06	0.1

*Sgnificant at P <0.05 ; ** Significant at P < 0.01.

amendments, respectively. In deep–tillage treatments its density was < 1 in rice–straw amendment and increased to 4.2 in farmyard manure amendment. In perennial ley treatments, its density was 1.6 in pigeon pea treatment which increased to 8.1 in pigeon pea + S. hamata treatment. ANOVA showed that the densities of Poduridae were significantly different in the tillage and organic amendment treatments (P< 0.01) and perennial ley treatments (P < 0.05) between seasons. ANOVA of the monthly data showed the population densities of Poduridae were significantly different across all the treatments during August (P < 0.05) and October 1997 (P<001). Besides, their densities were also significantly different across the tillage x amendment interaction during July and across organic amendment treatments (P <0.05) During November 1997. The densities were also significantly different across the perennial ley treatments during November 1997 (P < 0.01).

Sminthuridae:

Its relative population densities across the 15 treatments presented in Fig. 1 revealed that the mean density was < 1 in deep–tillage bare treatment, which increased to 3.7 in shallow–tillage rice straw amendment. Under annual crop, in zero, shallow–and deep–tillage treatments its densities were low (1.1, 0.5 and 0.4) in bare amendments and increased in rice–straw amendments (2.5, 3.7, and 2.1),

Table-1. Analysis of variance (mean squares) of the data on the mean population densities of soil–surface arthropods across perennial ley treatments during different months, 1996-1997 (numbers in parentheses represent degrees of freedom)

Year and month	Source of variation			
	Arthropod taxa	Treatment (5)	Error (4)	Mean abundance
1997, July	Prostigmata	0.4*	0.1	0.2
August	"	26.5**	1.2	2.2
1997, April	Prostigmata	7.0**	0.5	2.1
June	"	1.2*	0.1	3.1
1997, August	Cryptostigmata	0.4*	0.1	0.2
1996 December	Mesostigmata	2.2*	0.3	0.5
1997, October	"	2.2*	0.2	1.1
1997, November	Diplopoda	0.6**	0.1	0.2
1997, June	Entomobryidae	1.0*	0.2	0.3
1997, June	Isotomidae	4.0**	0.2	1.4
1997, November	Poduridae	9.0**	1	1.8
1996,August	Sminthuridae	4.0**	0.1	1.2
1996, October	Megalodiene Sp.	0.5*	0.1	0.2
1997, September	"	1.0*	0.2	0.5
November	"	0.5*	0.1	0.4
1997, September	Hymenoptera	20.0*	2	6.5
1996, August	Psocoptera	0.7*	0.1	0.3
1997, July	"	245.0*	23	7.0
1997, July	Orthoptera	3.0*	0.5	1
September	"	0.4*	0.1	0.3
1997, October	Lepidoptera larvae	1.4 *	0.2	0.5

*Significant at $P < 0.05$; ** Significant at $P < 0.01$.

respectively. In perennial ley treatments, its density was 0.8 in pigeon pea treatment and increased to 3 in S. hamata treatment. However, the densities were significantly different across all the 15 treatments, as revealed by the ANOVA during rainy season ($P < 0.05$). Besides, the densities were also significantly different across tillage and organic amendment treatments between seasons ($P<0.01$), organic amendment ($P<0.01$), season and amendment interaction ($P<0.01$) and tillage treatments ($P<0.05$). The densities were significantly different across the perennial ley treatments between seasons ($P<0.01$), season and treatments interaction ($P<0.05$). ANOVA of the monthly data showed that the population densities of Sminthuridae were significantly different across all the treatments during July 1997 (P<0.05). Besides the densities were also significantly different across the organic amendment during September 1996 and 1997 (P<0.01) across tillage x amendment interaction during August 1996 (P<0.05), and the perennial ley treatments during August 1996 (P<0.01).

Prostigmata:

Its relative population densities across the 15 treatments presented in Fig. 1 revealed that the mean density was 0.2 in annual treatments compared with those of the perennial ley treatments (1.6). Under annual crop, in zero–tillage treatments, the densities ranged between 0.6 and 1.4, in shallow–tillage treatments, its densities were < 1 and in deep–tillage treatments, its densities ranged between 0.3 and 1.4. In perennial ley treatments, its density was < 1 in C. ciliaris + S. hamta treatment which increased to 1.6 in pigeon pea treatments as revealed by the ANOVA during the rainy season (P<0.01). Besides the densities were also significantly different across tillage and organic amendment treatments between seasons (P<0.01). The densities were significantly different across the perennial ley treatments between seasons and season and treatments interaction (P < 0.01). ANOVA of the monthly data showed that the densities were significantly different across all the treatments during August 1996 (P<0.001), July, August, and September 1997 (P<0.01). Besides, the densities were significantly different across the organic amendment during September 1996 August and September1997 (P<0.05), across tillage treatments during August and September 1997 (P<0.01) and the perennial ley treatment during July 1996 (P<0.05), August 1997 and April 1997 (P< 0.01) and June 1997 (P< 0.05).

Cryptostigmata:

Its relative population densities across the 15 treatments presented in Fig. 1 revealed that the mean densities were < 1 in both annual (0.65) and perennial (0.07) treatments. Under the annual treatments, its mean density ranged between 0.10 and 0.57 and in the perennial treatments, it ranged between 0.07 to 0.51. However, the densities were significantly different across all the 15 treatments, as revealed by the ANOVA during the rainy season (P< 0.05). Besides, the densities were also significantly different across the tillage and organic amendment treatments between seasons (P<0.01) and seasons x tillage x amendment interaction (P<0.01) and perennial ley treatments between seasons (P<0.01). ANOVA of the monthly data showed that the population densities of Cryptostigmata were significantly different across all the treatments during August 1996 and 1997 (P<0.01). Besides, the densities were also significantly different across all the treatments during August 1996 and 1997 (P<0.01). Besides, the densities were also significantly different across the tillage treatments during August 1996 (P<0.05) and organic amendment during August 1996 and 1997 (P<0.05) and the perennial ley treatments during August 1997 (P< 0.05).

Mesostigmata:

Its relative population densities across the 15 treatments presented in Fig. 1 revealed that the mean density was significantly low (< 1) in annual treatments compared with those of the perennial ley treatments (1.7). Under the annual crop, in zero–tillage treatments, its mean density was low (< 1) in farmyard manure amendment, which increased (1.1) in rice–straw amendment. In shallow-tillage treatments, its mean density was <1 across the organic amendment treatment. In deep–tillage and perennial treatments, the densities showed very little variation, ranging between < 1 and 1.4 in the former, and between < 1 and 1.8 in the latter treatments. Their densities showed significant difference across the tillage and organic amendment treatments, as revealed by the ANOVA between seasons (P<0.01) and season and tillage interaction (P<0.05). Besides, the densities differed significantly across the perennial ley treatments between seasons (P<0.01). ANOVA of the monthly data showed that the densities were significantly different across all the treatments during December 1996 and September 1997 (P<0.05). Besides, its densities were also different across the tillage treatment during August and September 1997(P<0.05) and the perennial ley treatments during December 1996 and October1997 (P< 0.05).

Astigmata:

Its relative population densities across the 15 treatments presented in Fig. 24a revealed that the mean density was negligible (<1) in all the treatments. However, the densities significantly differed across all the 15 treatments, as revealed by the ANOVA during the rainy seasons (P<0.05). ANOVA of the monthly data showed that the population densities of Astigmata were significantly differed across all the treatments during August 1997 (P<0.05) and September 1997 (P<0.01). Besides, the densities were also significantly different across the tillage (P<0.01) and organic amendment treatments (P < 0.05) during September 1997.

Diplopoda:

Its relative population densities across the 15 treatments presented in Fig.1 revealed that the population was negligible (<1) across the treatments. However, the densities were significantly different across the tillage and organic amendment treatments, as revealed by the ANVOA between seasons (P<0.05). ANOVA of the monthly data of perennial ley treatments showed that the densities differed significantly across the treatments during November 1997 (P>0.01) was low in farmyard manure amendment (1.4) and increased to 2.23 in bare amendment. In perennial ley treatments, its density was low (< 1) in pigeonpea treatment, which increased to 2.4 in C. Ciliaris treatment. ANOVA showed that the densities of isotomidae were significantly different in the tillage and organic amendment treatments across seasons (P<0.01), tillage (P<0.05), season and tillage interaction (P<0.05). ANOVA of the monthly data showed that the densities were also different across the tillage during April, June, and October 1997 (P<0.05). Besides, the densities differed significantly across the perennial ley treatments during June 1997 (P< 0.01).

Poduriade:

Its relative population densities across the 15 soil management treatments presented in Fig.1 revealed that the mean density was significantly low (<1) in annual treatments compared with those of the perennial ley treatments (8.1).Under annual crop, in zero–and shallow tillage treatments, the density was low in bare amendment (1.23) and (0.61) which increased to 4.6 and 2.7 in farmyard manure amendments, respectively. In deep–tillage treatments its density was < 1 in rice–straw amendment and increased to 4.2 in farmyard manure amendment. In perennial ley treatments, its density was 1.6 in pigeon pea treatment which increased to 8.1 in pigeon pea + S. hamata treatment. ANOVA showed that the densities of Poduridae were significantly different in the tillage and organic amendment treatments (P< 0.01) and perennial ley treatments (P < 0.05) between seasons. ANOVA of the monthly data showed the population densities of Poduridae were significantly different across all the treatments during August (P < 0.05) and October 1997 (P<001). Besides, their densities were also significantly different across the tillage x amendment interaction during July and across organic amendment treatments (P <0.05) During November 1997. The densities were also significantly different across the perennial ley treatments during November 1997 (P < 0.01).

DISCUSSION

The soil surface arthropods collected across the 15 different soil management treatements belonged to 25 different arthropod taxa, and Hymenoptera (Formicidae) was the dominant taxa, followed by Collembola and Acarina, Blumberg and Crossley (1983) collected arthropods belonging to 150 species from pitfall traps in convential tillage and no–tillage systems in the old field systems. Ao (1987) reported a collection of arhtoropods belonging to more than 35 different taxa of arthropods from the upland rice and maize ecosystems. Braman and Pendley (1993) reported a relative abundance of more than 203,050 predators, parasites, and decomposers in centipede grass, Carabidae and Hymenoptera being significantly more abudnat.

Abbott et al (1979) recorded the number of Hymenoptera often being higher in virgin soils and soils which had not been ploughed or stocked for 7 years in Western Australia wheatbelt. Further, House and Stinner (1983) also reported that the present finding are in consistence with this number of Hymenoptera were higher in old–field pitfall traps from either of the two cropping systems–conventional tillage and no–tillage. Ao (1987) reported ants as the dominant group followed by Collembola in the upland rice and mazie ecosystems. Braman and Pendley (1983) noted that Collembola were in large numbers in centipeds grass. Prostigmata was the most dominant taxa among Acarina, followed by Mesostigmata, Cryptostigmata and Astigmata. In corroboration to these findings, Ao

(1987) reported that Prostigmata was next to the Cryptostigmata, followed by Astigmata and Mesostigamata. Braman and Pendley (1993) reported a higher number of Cryptostigmatid mites in centipede grass as influenced by management practices.

In the present study, three families of beetles were recorded, of which carabidae was dominant, followed by Erotylidae (Megalodicne sp)and staphylinidae. However, the species composition and total numbers recorded during the present study is far less than the finidng of Thiele (1977) who reported eight important Carabid species in the arable land of Europe. Holo Painen (1983) reported a total catch of 790 invidividuals of 35 species from cruciferous crops in organic and conventional forms in central Finaland. Further, Hokkanen and Holopainen (1986) recorded 4545 Carabid beetles of 55 species from biologically and conventionally managed cabbage fields. Kromp (1989) reported a total of 12.340 carabids belonging to 80 species from biologically and conventionally farmed agroecosystems. Braman and Pendley (1993) recorded 22 species of carabids and 17 Staphylinid speices in Centipede grass as influeneced by various management practices.

The perennialley treatments significantly affected the population densities of Dermaptera, Orthoptera, Hemiptera, Homoptera, Lepidoptera larve and Araneae across seasons (P<0.01), while those of Homoptera were significantly affected by the treatments (P<0.01). Besides, the mean densities of Psocoptera and Dermaptera were significantly affected by all the treatments during August 1997 (P<0.05) whiel those of Orthoptera (P<0.01) and Araneae (P < 0.05) were significantly affected by all the 15 treatments during July 1997. Orthoptera and Homoptera were significantly affected by all the 15 treatments during September 1997 (P<0.05).The population densities of Psocoptera were significantly affected by the tillage treatments during December 1996(P< 0.05), August, September, and November 1997 (P<0.01), and by tillage x amendment interaction during September 1997 (P<0.01), and those of Dermaptera were significantly affected by the annual tillage treatment during August 1997 (P<0.05) and organic amendments during August 1996 (P<0.05), September 1996 (P < 0.01), June (P<0.05), July (P<0.01), October (P< 0.01), and November 1997 (P<0.05). The densities of Orthoptera showed significant response to the organic amendment treatments during September 1997 (P<0.01), and those of Thysanoptera showed significant response to the annual tillage treatments during October 1997 (P<0.05). The densities of Araneae were significantly affected by the tillage x amendment interaction during July and September 1997 (P<0.05). The population densities of Psocoptera were significantly affected by the perennial ley treatments during August 1996 (P<0.05) and July 1997 (P< 0.05) and Orthoptera during July and September 1997 (P<0.05) and Lepidoptera larvae during October (P<0.05). Paoletti (1987) observed greater numbers of spiders in reduced tillage and no–tillage system than in conventionally ploughed corn systems. A similar trend was reported for corn systems in Ohio after 20 years of continuous treatment (Stinner et al, 1988). House and stinner (1983) reported that the spiders frequently occurred in higher numbers in no–tillage than in conventional tillage systems. No–tillage spatial heterogeneity and vegetational stratification may have promoted higher species diversity for some arthropod guilds (Murdoch et al, 1972). House and Stinner (1983). Observed that greater abundance of predatory foliage– inhabiting arthropods such as hemipetra was found in no–tillage systems than in conventional tillage. Further, Troxclair and Boethel (1984) reported that the density of Hemiptera was higher in Louisiana no–tillage soybeans in some sites and lower in other locations, when compared with conventionally tilled systems. However, there is little information in the literature on these aspects of the above groups to compare with the findings of the present study.

Conflict of Interests:

The authors declare that there is no conflict of interests regarding the publication of this paper.

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