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### **Original Research Article**

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# Estimation of Soil Macro Arthropods in Cotton Intercropped with Groundnut under Organic, Integrated and Conventional Farming Systems

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#### ABSTRACT

#### Keywords

Soil macro arthropods, Conventional and pitfall traps.

Article Info

Accepted: 29 April 2017 Available Online: 10 May 2017 A field investigation was undertaken during *Kharif*-2013 to estimate the population of soil macro arthropods in cotton intercropped with groundnut under organic, integrated and conventional farming systems. Soil macro arthropod consists of ants, scarabid beetles, centipedes, millipedes and others. Among the different farming systems, organic farming recorded more population of total soil macro arthropods (147.64/15 pitfall traps) followed by integrated farming system (119.71/15 pitfall traps) and conventional farming system (91.90/15 pitfall traps). Irrespective of farming systems the population of soil macro arthropods gradually increased from first fortnight of June (88.22/15pitfall traps) and reached to peak population during second fortnight of August (190.56/15pitfall traps) and gradually decreased to least population during second fortnight of December (52.11/15pitfall traps).

#### Introduction

Soil is the most valuable resource, since this is essential to the entire plant life on which animal and human life depends. Soil contains wide assortment of organic, inorganic substances, water and gases thus provide a unique medium for growth and development of micro-organisms and soil invertebrates. In general, soil invertebrates are classified according to their size into three classes viz., micro fauna, meso fauna and macro fauna. Soil ecosystem services are reliant upon soil fauna which provide benefit to human population. They support most production systems through soil formation, nutrient cycling and primary production and also participate in provision of regulation services

like climate regulation and detoxification. Without soil organisms, the soil would be a sterile medium that could not sustain crop production. Soil biota provides essential benefits for the functioning of agro ecosystems which are important for the long term sustainability of agriculture. They support essential soil processes and play a key role in maintaining the soil quality that is productivity. necessary for crop Soil organisms help to create and maintain beneficial soil structure and decomposing crop residues so that valuable nutrients are released for plant growth and contribute to soil carbon storage by mixing organic materials with mineral soil. Long-term and large number of soil inorganic fertilizer applications can affect negatively on soil fertility, soil biodiversity and crop products quality (Gruzdeva et al., 2007). By, considering the increasing importance of organic agriculture, soil organic manure applications are desirable and recommended. The effect deriving from organic manure applications includes numerous benefits resulting in an improvement of physical, biological and chemical soil properties, *i.e.* porosity, aggregates stability, water exchange and fertility (Tester, 1990). Heavy agricultural reliance on synthetic-chemical fertilizers and pesticides is having deleterious impacts on soil arthropods and the environment. With this background studies on soil arthropods in different farming systems were taken up.

#### Materials and Methods

The experiment was conducted during kharif 2013 at UAS Dharwad campus. The experiment was conducted with pitfall traps to know population of soil macro fauna which are moving above the ground. Pitfall traps are helpful in collecting the surface moving arthropods these are helpful to know the count of surface moving soil macro arthropods. Fifteen pitfall traps were placed in each field agriculture, horticulture and forest of ecosystems for collection of soil macro fauna.. Fifteen pitfall traps were placed in each field of cotton intercropped with groundnut under organic, integrated and conventional farming systems for collection of soil macro fauna. The trap consists of plastic cups (5 cm in dia 7 cm in height). The traps were buried in the ground with their rim leveled with the soil surface to facilitate wandering fauna to fall inside. Each cup was filled with 50 ml of 75% ethyl alcohol as killing agent with bit of glycerol to prevent the evaporation of alcohol. Observations were taken with fifteen days interval starting from June till the harvest of the crops. Population

of each group was recorded. Further these were separated as different taxonomic groups and preserved for further needful. Data were subjected to statistical analysis by two ways ANOVA.

#### **Results and Discussion**

Organic farming system was recorded significantly higher population of 10.83 centipedes /15 pitfall traps, 11.29 spiders /15 pitfall traps, 13.86 others (cockroach, grasshoppers, crickets)/15 pitfall traps and 147.64 total macro arthropods /15 pitfall traps. This system was followed by integrated farming system in which population of 8.98 centipedes /15 pitfall traps, 8.90 spiders /15 pitfall trap), 5.00 others (cock roach, grass hoppers, crickets /15 pitfall traps and 119.71 total macro arthropods /15 pitfall traps) and least population of 7.26 centipedes /15 pitfall traps, 6.67 spiders /15 pitfall traps and 91.90 total macro arthropods/15 pitfall traps were recorded in conventional farming system 1). Centipedes population was (Table gradually increased from first fortnight of June (5.00/15 pitfall traps) and attained maximum during first fortnight of August (16.88/15 pitfall traps) then gradually decreased and attained minimum population during second fortnight of December (2.44/15 pitfall traps). Interaction effect was found significant. Significantly highest centipede population was recorded in organic farming system during first fortnight of August (19.67/15 pitfall traps). Least population was recorded in conventional farming system during second fortnight of December (1.67/15 pitfall traps) (Table 1). Spiders population gradually increased from first fortnight of June (6.88/15 pitfall traps) and attained maximum population during second fortnight of August (15.00/15 pitfall traps) then gradually decreased and attained minimum population during second fortnight of December (3.22/15 pitfall traps) (Table 1).

Interaction effect was found significant. Significantly highest spiders population was found in organic farming system with second fortnight of August (18.00/15 pitfall traps) and significantly least population was in conventional farming system during second fortnight of December (2.00/15 pitfall traps) (Table 1). Population of other arthropods gradually increased from first fortnight of June (10.22/15 pitfall traps) and attained maximum population during second fortnight of July (17.55/15 pitfall traps) then gradually decreased and attained minimum population during second fortnight of December (5.88/15 pitfall traps). Interaction effect between different farming systems and dates of collection of arthropods did not differ significantly (Table 1). Population of total micro arthropods gradually increased from first fortnight of June (88.22/15 pitfall traps) attained maximum during second and fortnight of August (190.56/15 pitfall traps) then gradually decreased and attained minimum during second fortnight of December (52.11/15 pitfall traps) (Table 1). The interaction effect was also found significant. Significantly highest total macro arthropods was found in organic farming system during second fortnight of August (230.33/15 pitfall traps) and least was in conventional farming system during second fortnight of December (30.33/15 pitfall traps) (Table 1).

Irrespective of crops total soil macro fauna recorded was more in organic farming system followed by integrated and conventional farming systems. Total soil macro fauna comprised of ants, carabid beetles, spiders, centipedes, scarabids, millipedes. Most of the soil macro fauna are predatory in habit so, these predators are density dependent when the meso arthropods population is more automatically that will help to increase the soil macro arthropods. It may be also due to abundance of organic matter, microbial biomass, optimum moisture, soil temperature and food availability. Present findings are in corroborating with Shilpa *et al.* (2013), they have also recorded higher macro fauna in 20t of FYM per hectare treated plots along with native soil fauna. This may be due to abundant ant nests associated with ample food sources (organic matter, microbial biomass and prey etc), optimal soil moisture and temperature regimes in the soil and it may also be due to feeding habit, host preference and favorably altered microclimate during crop growth stages.

Present findings corroborate with the observations of Minarro et al., (2009) they also reported that ground beetles (Carabids), beetles (Staphylinidae), rove ants (Formicidae) and spiders (Araneae) sampled monthly with pitfall traps in the apple orchard a total of 4978 individuals collected. Carabids (56.8 % of the total catches) were the most abundant taxonomic group, followed by spiders (20.7 %), ants (14.8 %) and rove beetles (7.7 %). Present findings are also in line with Braman and Pendley (1993), Naureen et al., (2010) they were also concluded that the deterioration of macroinvertebrates population was less evident in organically managed fields compared to high input farming practices. The peak population occurred when there was sufficient rainfall. sunshine hours, food availability with moisture and preferable optimum soil optimum soil temperature during cropping period and also it may be due to the availability of suitable food (prey, vegetation etc).

Present findings are in close agreement with Abilasha *et al.*, (2013b) who reported that fluctuation and gradual increase in the abundance of the soil macro-fauna from BAT (Before application of treatments) was noticed in baby corn ecosystem. Highest population was noticed during 75 DAG.

Date of collection(DC)	Centipedes (No./15 pitfall traps)				Spiders (No./15 pitfall traps)				Others (cockroach, crickets and grasshoppers)(No./15 pitfall traps)				Total macro arthropods (No./15 pitfall traps)			
Farming systems (FS)	OF	IF	CF	Mean	OF	IF	CF	Mean	OF	IF	CF	Mean	OF	IF	CF	Mean
June I fortnight	7.00 (2.74)	5.00 (2.35)	3.00 (1.87)	5.00k	9.67 (3.19)	7.00 (2.74)	4.00 (2.12)	6.88h	13.67 (3.76)	10.00 (3.24)	7.00 (2.74)	10.22i	117.67 (10.87)	86.00 (9.30)	61.00 (7.84)	88.22k
June II fortnight	11.00 (3.39)	8.67 (3.03)	7.00 (2.74)	8.88h	10.67 (3.34)	7.67 (2.86)	5.67 (2.48)	8.00 f	17.67 (4.26)	14.67 (3.89)	10.67 (3.34)	14.33e	130.67 (11.45)	105.00 (10.27)	84.00 (9.19)	106.56i
July I fortnight	12.67 (3.63)	12.00 (3.54)	9.67 (3.19)	11.44d	15.00 (3.94)	12.00 (3.54)	10.00 (3.24)	12.33b	15.00 (3.94)	14.00 (3.81)	11.00 (3.39)	13.33f	138.33 (11.78)	120.67 (11.01)	102.67 (10.16)	120.56f
July II fortnight	12.00 (3.54)	10.67 (3.34)	9.67 (3.19)	10.77e	14.00 (3.81)	12.67 (3.63)	10.00 (3.24)	12.22b	19.00 (4.42)	18.00 (4.30)	15.67 (4.02)	17.55a	152.00 (12.35)	133.00 (11.55)	113.67 (10.69)	132.89e
Aug I fortnight	19.67 (4.49)	17.00 (4.18)	14.00 (3.81)	16.88a	15.67 (4.02)	12.00 (3.54)	9.00 (3.08)	12.22b	16.33 (4.10)	17.00 (4.18)	14.00 (3.81)	15.77c	223.67 (14.97)	174.67 (13.24)	131.00 (11.47)	176.44c
Aug II fortnight	17.67 (4.26)	15.67 (4.02)	13.00 (3.67)	15.44b	18.00 (4.30)	15.00 (3.94)	12.00 (3.54)	15.00a	18.00 (4.30)	14.67 (3.89)	12.67 (3.63)	15.11d	230.33 (15.19)	191.67 (13.86)	149.67 (12.25)	190.56a
Sep I fortnight	18.00 (4.30)	15.00 (3.94)	12.00 (3.54)	15.00c	14.00 (3.81)	11.67 (3.49)	8.67 (3.03)	11.44c	19.00 (4.42)	16.00 (4.06)	15.00 (3.94)	16.66b	211.33 (14.55)	179.67 (13.42)	145.00 (12.06)	178.67b
Sep II fortnight	12.00 (3.54)	9.00 (3.08)	8.67 (3.03)	9.88f	12.67 (3.63)	9.67 (3.19)	7.67 (2.86)	10.00d	14.67 (3.89)	12.00 (3.54)	10.67 (3.34)	12.44g	178.67 (13.39)	149.33 (12.24)	118.33 (10.90)	148.78d
Oct I fortnight	11.00 (3.39)	10.00 (3.24)	7.00 (2.74)	9.33g	10.00 (3.24)	8.67 (3.03)	6.67 (2.68)	8.44e	12.67 (3.63)	11.00 (3.39)	9.00 (3.08)	10.88h	157.33 (12.56)	100.33 (10.04)	98.00 (9.92)	118.56g
Oct II fortnight	10.00 (3.24)	8.00 (2.92)	7.67 (2.86)	8.55i	8.67 (3.03)	7.00 (2.74)	5.00 (2.35)	6.88h	10.00 (3.24)	8.00 (2.92)	7.00 (2.74)	8.33j	136.67 (11.71)	121.00 (11.02)	85.67 (9.28)	114.44h
Nov I fortnight	7.67 (2.86)	6.00 (2.55)	4.67 (2.27)	6.11j	7.00 (2.74)	5.67 (2.48)	3.67 (2.04)	5.44j	9.67 (3.19)	8.00 (2.92)	6.67 (2.68)	8.11j	119.67 (10.96)	100.67 (10.06)	67.33 (8.24)	95.89j
Nov II fortnight	4.67 (2.27)	3.00 (1.87)	1.67 (1.47)	3.11m	10.00 (3.24)	7.00 (2.74)	5.00 (2.35)	7.33g	10.00 (3.24)	7.00 (2.74)	4.67 (2.27)	7.22k	107.67 (10.40)	87.00 (9.35)	55.67 (7.49)	83.441
Dec I fortnight	4.67 (2.27)	3.67 (2.04)	2.00 (1.58)	3.441	8.00 (2.92)	5.67 (2.48)	4.00 (2.12)	5.88i	8.67 (3.03)	5.67 (2.48)	3.67 (2.04)	6.001	90.67 (9.55)	73.33 (8.59)	44.33 (6.70)	69.44m
Dec II fortnight	3.67 (2.04)	2.00 (1.58)	1.67 (1.47)	2.44n	4.67 (2.27)	3.00 (1.87)	2.00 (1.58)	3.22k	9.67 (3.19)	5.00 (2.35)	3.00 (1.87)	5.881	72.33 (8.53)	53.67 (7.36)	30.33 (5.55)	52.11n
Mean	10.83a	8.98b	7.26c	9.02	11.29a	8.90b	6.67c	8.95	13.86a	11.50b	9.33c	11.56	147.64	119.71	91.90	119.75
Farming Systems (FS)	0.03		0.07		0.02		0.07		0.03		0.08		0.08		0.22	
Date of collection (DC)	0.05		0.15		0.05		0.14		0.06		0.17		0.17		0.48	
FSXDC	0.09		0.27		0.09		0.25		0.11		NS		0.30		0.83	

# **Table.1** Population of soil macro arthropods in cotton Intercropped with groundnut under organic, integrated and conventionalfarming system during 2013 (Per 15 Pitfall traps)

OF - Organic farming IF - Integrated farming CF - Conventional farming Figures in the parenthesis are  $\sqrt{x+05}$  transformed values NS - Non-significant

The present findings are in close agreement with the observations of Shilpa et al., (2013) reported treatments with application of FYM supported higher macro fauna and Umadevi et al., (2013) reported higher macro faunal activity was observed on 45 DAG (53.99/trap). Absence of chemicals, no or low levels of soil disturbance and eco friendly management techniques in organic fields which completely or partially absent in conventional managed fields, resulted in the buildup of beneficial arthropods (Mader et al., conventional farming 2002). In less population of micro arthropods was recorded. It may be due to intensive agriculture and excessive use of agrochemicals have resulted in an impoverished wild life especially reduced arthropod diversity and density in agriculture ecosystem. Because of high input fertilizers and pesticides a severe decline of biological diversity has been observed (Letourneau and Bothwell, 2008). The results also in line with the Patil et al., (2013), Ayuke et al., (2004), Santigo et al., (2009), Abbas and Parwez (2012) who have also reported that abundance of total micro arthropod population four times higher in organic farming system compared than to conventional farming system. Harsh climatic conditions could lead to gradual losses of micro arthropods.

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