Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

**E-ISSN:** 2278-4136
**P-ISSN:** 2349-8234
JPP 2019; 8(3): 935-937
Received: 10-03-2019
Accepted: 12-04-2019

**Mamta Devi**
Department of Soil Science & Agril. Chemistry, SKUAST-J, Chatha, Jammu and Kashmir, India

**NM Konde**
Assist. Professor, Department of Soil Science & Agril. Chemistry, Dr. PDKV, Akola, Maharashtra, India

**PW Deshmukh**
Assist. Professor, Department of Soil Science & Agril. Chemistry, Dr. PDKV, Akola, Maharashtra, India

**DV Mali**
Assist. Professor, Department of Soil Science & Agril. Chemistry, Dr. PDKV, Akola, Maharashtra, India

**AN Paslawar**
Assoc. Professor, Associate Professor, cotton research unit Dr. PDKV, Akola, Maharashtra, India

**Correspondence**
**Mamta Devi**
Department of Soil Science & Agril. Chemistry, SKUAST-J, Chatha, Jammu and Kashmir, India

# Effect of tillage and intercropping on yield and soil health under rainfed condition

**Mamta Devi, NM Konde, PW Deshmukh, DV Mali and AN Paslawar**

**Abstract**
A field study was conducted at Agronomy farm, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra) during *kharif* season. The experiment was laid out in randomized block design with three replication and ten treatments consisting two tillage practices conventional tillage (CT) and minimum tillage (MT). The higher yield was recorded in pigeonpea + sunhemp (GM) MT. Organic carbon, SMBC,DHA, available NPK were found improve after harvesting of crops. Nitrogen, Phosphorus and Potassium addition through biomass available for *in-situ* recycling and moisture content was found greater in minimum tillage as compared to conventional tillage.

**Keywords:** Biomass, conservation tillage, intercropping, minimum tillage and conventional tillage

## Introduction
The main concept of intercropping is to get increased total productivity per unit area and time. There are ample evidences to show that, the total yield can be increased with intercropping over sole cropping. One of the main reasons for higher yields in intercropping is that the component crops are able to use growth resources differently, so that when grown together, they complement each other and make better overall use of growth resources than grown separately (Willey, 1979) [15]. Intercropping of pulses and oilseed is one of the ways to increase pulse and oilseed production as it is more advantageous than the sole cropping of both pulses and oilseed (Lourduraj, *et al.*, 1998) [6]. Conventional tillage practices can result in significant losses of soil organic matter (SOM), inducing an increase in soil erosion and loss of soil. The primary objective of research on soil tillage is to characterize the soil conditions induced by tillage operation and to determine which of the resulting conditions are most favourable for plant growth. Conservation tillage are system of managing crop residues on the soil surface with minimum or no tillage.

## Materials and Methods
A field experiment entitled "carbon sequestration as influenced by tillage under soybean - pigeonpea intercropping in Inceptisol" was conducted at Agronomy farm, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (220 42' North latitude and 770 02' East longitudes and at an altitude of 307.42 m above mean sea level) (Maharashtra) during *kharif* season of 2014-15 on medium deep black soil. The experiment was laid out in randomized block design (RBD) with three replication consisting two tillage practices conventional tillage and minimum tillage Pigeonpea variety PKV-Tara, soybean variety JS-355 and sunhemp local variety were sown. Sunhemp was cut and used as mulch in conventional tillage plots and used as in situ green manuring in minimum tillage plots. Weeds after hand weeding were used as mulch in all plots. Average rainfall was 593.1 mm during crop period. Available nitrogen (Subbiah and Asija, 1956) [12], phosphorus (Olsen *et al.* 1954), potassium (Jackson, 1973) [1], organic C (Nelson and Sommer, 1982) inorganic C (Jackson, 1973) [1], SMBC (Jenkinson and Powlson, 1976), DHA Klien,(1971), Soil pH and EC (Jackson, 1973) [1] by ectrical conductivity meter.

## Results and Discussions

**Table 1:** Effect of tillage and intercropping on grain & straw yield of pigeonpea and soybean

| Treatments | Grain yield (q $h^{-1}$) | straw yield (q $h^{-1}$) |
|---|---|---|
| Sole pigeonpea under CT | 5.41 | 10.52 |
| Sole soybean under CT | 4.81 | 6.13 |
| Pigeonpea + soybean (1:2) under CT | 5.12 | 7.60 |
| Pigeonpea + sunhemp(GM) under CT | 5.47 | 10.68 |
| Pigeonpea + soybean (1:5) under CT | 4.98 | 7.05 |
| Sole pigeonpea under MT | 6.09 | 11.38 |
| Sole soybean under MT | 5.25 | 6.55 |
| Pigeonpea + soybean (1:2) under MT | 5.61 | 8.25 |
| Pigeonpea + sunhemp (GM) under MT | 6.20 | 11.45 |
| Pigeonpea + soybean (1:5) under MT | 5.45 | 7.45 |
| SE (m±) | 0.08 | 0.09 |
| CD at 5% | 0.24 | 0.27 |

### Yield

During the course of investigation, considering the effect of tillage and intercropping on grain and straw yield of pigeonpea + soybean intercropping, the relative yield was considered. The pigeonpea and soybean was grown in proportion (1:2 and 1:5) in treatment $T_3$, $T_5$ under conventional tillage and $T_8$ & $T_{10}$ under minimum tillage respectively. The relative grain and straw yield of pigeonpea + soybean was significantly influenced by various treatments under pigeonpea + soybean intercropping. Significantly superior relative grain yield (6.20 $qha^{-1}$) of pigeonpea was recorded with treatment $T_9$ (Pigeonpea + sunhemp (GM) under MT), the yield obtained under treatment $T_4$ and $T_{10}$ were at with each other, while lowest grain yield was recorded under $T_2$ (Sole pigeonpea under CT). The grain yield under treatment $T_6$ was significantly higher than$T_1$. Where in $T_6$ Pigeonpea was grown under minimum tillage. Similarly, highest (11.45 $qha^{-1}$) relative straw yield of pigeonpea + soybean was obtained under treatment $T_9$. The lowest yield was recorded in $T_2$ (6.13$qha^{-1}$). While looking to the yield pattern of pigeonpea and soybean, comparatively lower yield of both the crop was observed as against its average yield, which must be because of undistributed and deficit rainfall obtained during 2014-15. Seema *et al.* (2014) [12] noted that Conservation agriculture improves productivity and soil quality, but most of the results are only confined to the rice–wheat system, zero tillage gave 5.4 and 2.3% higher pigeonpea and wheat yield, respectively, over conventional tillage.

**Table 2:** Effect of tillage and intercropping on chemical properties of soil after harvest of pigeonpea and soybean

| Treatments | pH | EC | N | P | K | SMBC | DHA |
|---|---|---|---|---|---|---|---|
| | | (dS$m^{-1}$ ) | (kg $h^{-1}$) | (kg $h^{-1}$) | (kg$h^{-1}$) | (µg $g^{-1}$ soil) | (µgTPF / g /h) |
| Sole pigeonpea under CT | 7.55 | 0.29 | 233.70 | 16.67 | 334.40 | 264.43 | 53.65 |
| Sole soybean under CT | 7.52 | 0.31 | 236.50 | 20.27 | 340.20 | 260.53 | 58.23 |
| Pigeonpea + soybean (1:2) under CT | 7.51 | 0.30 | 236.47 | 19.77 | 338.50 | 268.20 | 60.87 |
| Pigeonpea + sunhemp(GM) under CT | 7.42 | 0.27 | 243.43 | 23.04 | 347.60 | 278.23 | 63.63 |
| Pigeonpea + soybean (1:5) under CT | 7.57 | 0.31 | 237.67 | 21.08 | 339.37 | 274.36 | 62.05 |
| Sole pigeonpea under MT | 7.59 | 0.29 | 235.63 | 19.53 | 336.00 | 272.57 | 60.25 |
| Sole soybean under MT | 7.53 | 0.31 | 238.27 | 22.20 | 341.90 | 267.73 | 62.87 |
| Pigeonpea + soybean (1:2) under MT | 7.53 | 0.29 | 239.43 | 20.43 | 340.57 | 271.33 | 64.87 |
| Pigeonpea + sunhemp (GM) under MT | 7.32 | 0.26 | 245.17 | 24.43 | 349.37 | 283.93 | 69.70 |
| Pigeonpea + soybean (1:5) under MT | 7.44 | 0.30 | 240.33 | 22.77 | 342.90 | 278.65 | 68.61 |
| SE (m)± | 0.05 | 0.01 | 1.07 | 0.53 | 1.23 | 2.05 | 1.48 |
| CD at 5% | NS | NS | 3.21 | 1.59 | 3.69 | 6.15 | 4.44 |
| Initial | 7.60 | 0.28 | 210 | 15.40 | 318 | - | - |

### Electro-chemical and biological properties

The available nitrogen, phosphorus .organic C, inorganic C, SMBC, DHA, pH and EC was significantly improved in treatment where pigeonpea grown with sunhemp under minimum tillage. Due to addition of leaf litter and root biomass of all three crops value of organic C, and SMBC, DHA and available nitrogen, phosphorus and potaassium was higher than the initial value and these were also higher in minimum tillage. Soil pH was 7.32 which were slightly lower than initial soil pH (7.60). Lowest soil pH was found in pigeonpea + sunhemp under minimum tillage .It might due to addition of sunhemp as mulch. Kumar *et al*. (2008) [4], Rao and Janawade (2009) [11] who reported that pH and EC reduced slightly with application of FYM, crop residues and green manure. EC was significantly lower in pigeonpea + sunhemp. Similar result was found by Kumar *et al*. (2008) [4]. Due to green manuring of sunhemp crops recorded higher organic C content was found in pigeonpea + sunhemp (More and Hangarge, 2003; Lal and Jacinthe, 2009) [7, 5]. Available NPK and Total NPK added through biomass available for *in-situ* recycling were significantly highest in pigeonpea + sunhemp and lowest in sole pigeonpea (Prasad *et al.,* 1997; Paslawar *et al.,* 2007) [10, 9].

### Conclusion

In pigeonpea higher seed yield and straw per plant yield was found in pigenpea + sunhemp under minimum tillage. Significantly lower pH, EC and higher organic C, available NPK, SMBC and DHA was found in pigenpea + sunhemp under MT. Execution of intercropping with green manuring (sunhemp) under minimum tillage is having tremendous potential to improve physical, chemical and biological

properties of soil. Which thereby, resulting into enhancement in soil quality as well as increased crop.

**Reference**


1. Jackson ML. Soil Chemical Analysis. Prentice Hall of India Pvt. Ltd., New Delhi, 1973.
2. Jenkinson DS, Ladd JN. Microbial biomass in soil measurement & turnover in: Soil Biochemistry, 1981 415-471.
3. Klein DA, Loh TC, Goulding RL. A rapid procedure to evaluate the dehydrogenase activity of soils low in organic matter. Soil Biology and Biochemistry. 1971; 3(4):385-387.
4. Kumar B, Gupta RK, Bhandari AL. Soil fertility changes after long-term application of organic manures and crop residues under rice-wheat system. Journal of the Indian Society of Soil Science. 2008; 56(1):80-85.
5. Lal R, Jacinthe PA. Tillage effect on carbon sequestration and microbial biomass in reclaimed farm land soils of southwestern India. Soil Science Society of American Journal. 2009; 73:605-613.
6. Louduraj AC, Pannerselvam S, Sanbagavalli S. Intercropping in groundnut. Agricultural Science Digest. 1998; 18(3):195-7.
7. More SD, Hangarge DS. Effect of integrated nutrient supply on crop productivity and soil characteristics with cotton-sorghum cropping sequence in Vertisol. Journal of Maharashtra Agricultural Universities. 2003; 28(1):8-12.
8. Nelson DW, Sommers LE. Total carbon, organic carbon and organic matter. In: Methods of Soil Analysis Part-II. Page, A.L. (Ed.). Am. Soc. of Agron. Inc. Soil Sci. Soc. Am. Madison, 1982, 539-577.
9. Paslawar AN, Gawande RP, Shingrup RP, Sonali Thakare PV, Mali DV. Use of organic, inorganic and bio-fertilizer in pigeonpea + soybean intercropping system and its effect on yield, protein and physico-chemical properties of soil. Annals of Plant Physiology. 2007; 21(1):96-98.
10. Prasad SN, Singh R. Productivity, economics and residual fertility under rainfed soybean based intercropping system in South–Eastern Rajasthan. Indian Journal of Soil Conservation. 1997; 25(3):236-240.
11. Rao S, Janwade AD. Influence of integrated nutrient management practices on physico-chemical properties of cotton growing soils. Journal of Cotton Research and Development. 2009; 23(1):60-63.
12. Seema UK, Behera AR, Sharma TK. Das and Ranjan Bhattacharyya, 2014. Productivity, organic carbon and residual Soil rertility of pigeonpea–wheat cropping system under varying tillage and residue management. Proc. Natl. Acad. Sci., India, Sect. B Biol. Sci. DOI 10.1007/s40011-014-0359-y.
13. Subbiah BV, Asija GL. A rapid procedure for the estimation of available nitrogen in soils. Current Science. 1956; 25(8):259-260.
14. Walkley AJ, Black CA. Estimation of soil organic carbon by the chronic acid titration method. Soil Science. 1934; 37:29-38.
15. Willey RW. Intercropping-its importance and research needs. Part-I, Competition and yield advantages. Field Crop Abstracts. 1979; 32:1-10.