The Bioscan 12(1): 571-574, 2017 (Supplement on Agronomy)
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.com

EFFECT OF CONSERVATION TILLAGE ON BIOMASS PARTITIONING AND QUALITY OF PIGEONPEA BASED INTERCROPPING SYSTEM UNDER VIDARBHA REGION

RAJESH KUMAR* AND A. N. PASLAWAR
Department of Agronomy,
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharastra - 444 104, INDIA
e-mail: rajesh.kumarjat@ymail.com

KEYWORDS
Intercropping
Minimum tillage
Yield

Received on :
12.06.2016

Accepted on :
06.01.2017

***Corresponding author**

ABSTRACT
A field study was conducted at Agronomy farm, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra) during *kharif* season of 2012-13 to find out the economically efficient cropping system having higher system productivity. The experiment was laid out in factorial randomized block design with four replication consisting of two tillage practices (conventional tillage and minimum tillage) and four cropping systems[Sole pigeonpea, Pigeonpea + soybean (1:2), Pigeonpea + Sunnhemp (1:2) and Pigeonpea + soybean (1:5)]. Biomass of seed, stalk, pod straw and root and its share (%) was higher in minimum tillage. Maximum share of seed biomass (20.27%) was found in pigeonpea + soybean (1:2) and lowest in sole pigeonpea (15.37). Maximum seed yield (18.5q/ha) was found in sole pigeonpea which was at par with pigeonpea + Sunnhemp (1:2). Total protein yield (1070 kg/ha) and total N, P, K uptake by intercropping system were found in pigeonpea + soybean (1:2).

INTRODUCTION

Pigeonpea being, excellent source of high quality protein and carbohydrate it occupies an important place in vegetarian population. In India, pigeonpea occupied around 3.89 million ha with the production of 3.02 million tones and 776 kg/ha productivity. However, area under this crop in Maharashtra is 11.80 lakh ha with production of 9.66 lakh tonnes (DAC, 2014). 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). Conservation tillage has become an increasingly popular tool that grower have embraced as part of their production strategies. Besides minimizing soil erosion, conservation tillage can promote input saving through reduced usage of tillage equipment. This lower tillage aspects decrease fuel consumption, promotes longer machinery life, allows utilization of reduced horsepower implements, and lower labour requirement. However, these benefits can be slightly offset by increased chemical weed control costs. Tillage based conventional agriculture is assumed to have led to soil organic matter decline ,water runoff and soil erosion (Derpsch *et al*, 1991) and other manifestation of physical, chemical and biological soil degradation (Benites, 2008). Keeping all the views in mind an experiment was conducted to find out the effect of conservation tillage on yield, quality and nutrient uptake of pigeonpea based intercropping system under rainfed condition.

MATERIALS AND METHODS

A field experiment was conducted at Agronomy farm, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (20º 42' North latitude and 77º 02' East longitudes at an altitude of 307.42 m above mean sea level) during *kharif* season of 2012-13 on medium deep black soil. Treatment consisting of two tillage practices (conventional tillage and minimum tillage) and four levels of cropping system [sole pigeonpea, Pigeonpea + soybean (1:2), Pigeonpea + Sunnhemp (1:2), Pigeonpea + soybean (1:5)] was laid out in factorial randomized block design (FRBD) with four replication. Pigeonpea 'PKV-Tara', soybean 'JS-355' and Sunnhemp local variety were sown under the experimentation. Crops were sown on first week of July. Recommended dose of fertilizers (30:75:30 Kg/ha NPK) were applied to the crops. The crop of Sunnhemp was cut and used as mulch in conventional tilled plots, wheras, it was used as *in situ* green manuring in minimum tillage plots. Weeds were removed manually and used as mulching in the respective plots. Average rainfall received during the crop period was 591.3 mm. Soybean and pigeonpea were harvested in October and December, respectively. Yield from net plot are converted into yield per ha. All the data were statistically analysed using F-test as per the standard procedure.

RESULTS AND DISCUSSION

Effect on biomass partitioning

Results of the experiment (Table.1 and Fig.1.) shows that seed, stalk, pod straw, root biomass (kg/ha) and its share (%) at harvest was higher in minimum tillage. Whereas leaf biomass and its share was more in conventional tillage.In sole

Table 1: Total biomass of pigeon pea (kg/ha) and its share (%) with different parts as influenced by tillage practices and cropping system.

Treatments	Total biomass of pigeonpea (kg/ha) and its share (%) with different parts					
	Seed	Stalk	Pod straw	Leaves	Root	Total biomass
Tillage Practices						
Conventional Tillage	1420	2950	1060	2123	558	8111
	(17.5)	(36.36)	(13.06)	(26.17)	(6.88)	(100)
Minimum Tillage	1490	3110	1110	2038	561	8309
	(17.92)	(37.42)	(13.35)	(24.52)	(6.75)	(100)
Cropping systems						
Pigeonpea	1850	6060	1390	1992	738	12030
	(15.37)	(50.37)	(11.55)	(16.55)	(6.14)	(100)
Pigeonpea + Soybean (1:2)	1510	2400	1160	1845	532	7447
	(20.27)	(32.22)	(15.57)	(24.77)	(7.15)	(100)
Pigeonpea + Sunnhemp (1:2)	1800	2860	1330	1885	620	8495
	(21.11)	(33.66)	(15.65)	(22.18)	(7.3)	(100)
Pigeonpea + Soybean (1:5)	660	810	450	681	295	2896
	(22.78)	(27.96)	(15.53)	(23.5)	(10.2)	(100)
GM	1460	3030	1080	1760	550	7881
	(18.52)	(38.44)	(13.7)	(22.33)	(6.99)	(100)

Table 2: Effect of tillage practices and cropping system on NPK uptake (kg/ha) by pigeonpea and soybean and total uptake by system

Treatments	Seed Yield(q/ha)		Uptake by pigeonpea(kg/ha)			Uptake by soybean(kg/ha)			Total uptake by system (kg/ha)		
	Pigeon pea	Soybean	N	P	K	N	P	K	N	P	K
Tillage Practices											
Conventional Tillage	14.2	21.5	97.26	9.14	47.57	162.4	26.6	63.2	259.2	35.7	110.7
Minimum Tillage	14.9	18.8	101.3	9.57	49.70	144.3	25.8	62.8	245.3	35.3	112.5
CD at 5%	NS	-	NS	NS	NS	-	-	-	-	-	-
Cropping systems											
Pigeonpea	18.5	-	151.71	14.22	79.41				151.7	14.2	79.41
Pigeonpea + Soybean (1:2)	15.1	19.1	94.93	8.92	44.56	141.1	23.7	55.5	236.0	32.6	100.0
Pigeonpea + Sunnhemp(1:2)	18.0	-	113.36	10.70	53.59				113.3	10.7	53.59
Pigeonpea + Soybean (1:5)	6.6	21.3	38.04	3.58	16.96	165.0	28.2	70.5	203.6	31.7	87.46
CD at 5%	1.51		7.18	0.66	3.79						

Table 3: Effect of tillage practices and cropping system on Protein content (%), protein yield (kg/ha) and total protein yield (kg/ha) of pigeonpea and soybean

Treatments	ProteinContent (%)		Protein yield(kg/ha)		Total protein yield(kg/ha)
	Pigeonpea	Soybean	Pigeonpea	Soybean	
Tillage Practices					
Conventional Tillage	21.1	39.31	301	848	1149
Minimum Tillage	20.9	39.28	314	742	1056
CD at 5%	NS	-	NS	-	
Cropping systems					
Pigeonpea	20.9	-	388		388
Pigeonpea + Soybean (1:2)	21.1	39.18	319	750	1070
Pigeonpea + Sunhemp(1:2)	21.2	-	384		384
Pigeonpea + Soybean(1:5)	20.8	39.40	138	840	138
CD at 5%	0.22		32.47		

pigeonpea seed yield was highest and its share was lowest. Whereas seed biomass was lowest in pigeonpea + soybean (1:5) and its share (22.78%) was maximum. Stalk biomass and its share (50.37%) was maximum in sole pigeonpea and lowest stalk biomass and its share (27.29%) in pigeonpea + soybean (1:5). In pod straw maximum share (15.65%) was found in pigeonpea + soybean (1:2). In leaves maximum share (%) was found in pigeonpea + sunhemp. Due to wider spacing maximum share (%) of seed was found in pigeonpea + soybean (1:5). Pigeonpea growth and its share for yield was more in wider spacing due to intercropping of soybean. Photosynthesis conversion was more in intercropping than sole pigeonpea. Numerically higher seed yield of pigeonpea was recorded in minimum tillage as compared to conventional tillage. Whereas in soybean it was recorded in conventional tillage. The Highest seed yield per ha (18.5q/ha) were significantly recorded in sole pigeonpea being at par with pigeonpea + sunhemp (1:2) *i.e.* 18 q/ha and lowest with pigeonpea + soybean (1:5). Where as in soybean it was maximum yield (21.3q/ha) with pigeonpea + soybean (1:5), followed by pigeonpea + soybean (1:2). This shows that due to favourable environment created by the green manuring of sunnhemp, yield in pigeonpea + sunnhemp was almost similar to sole pigeonpea. Addition of sunnhemp increases soil

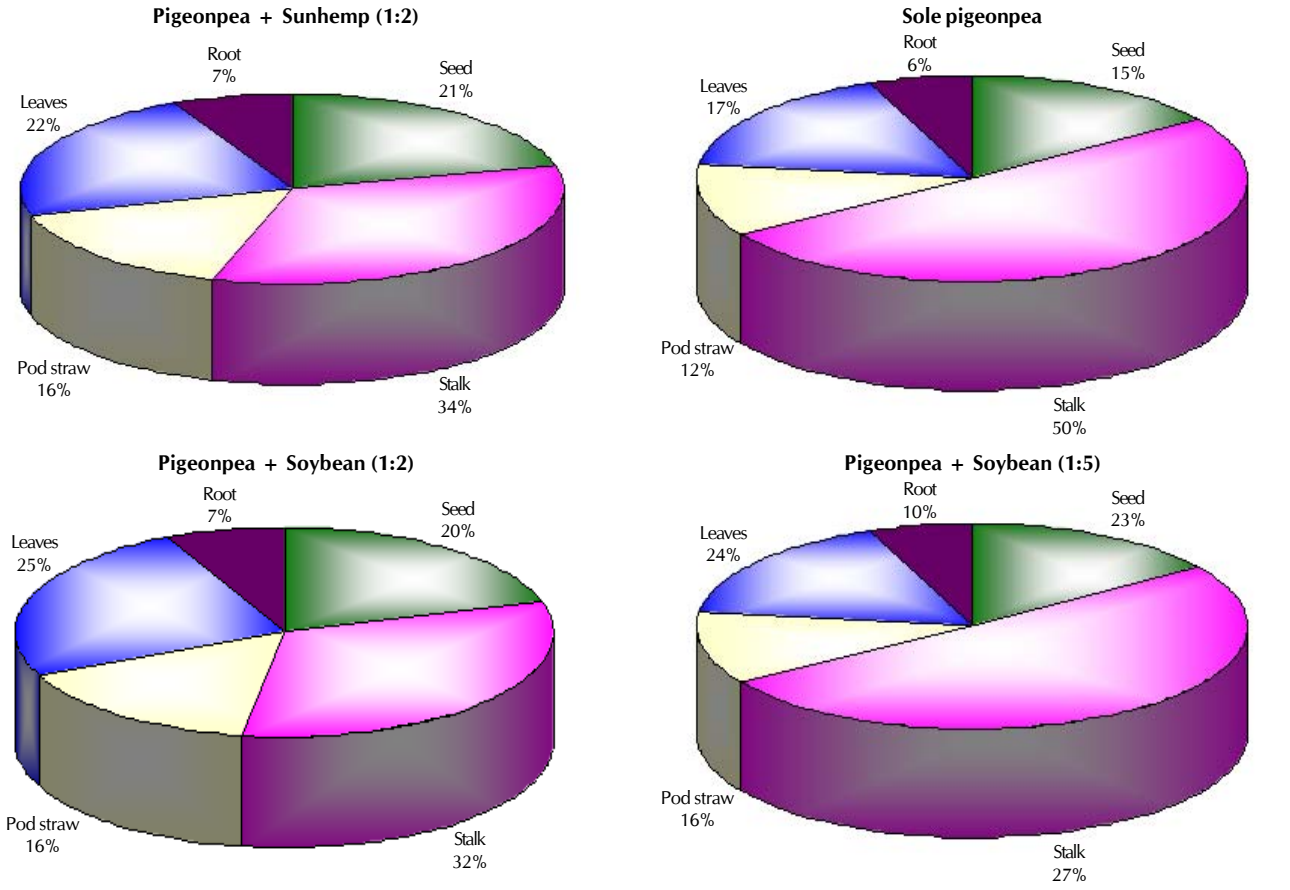

Figure1: Percentage share of pigeonpea with different parts as influenced by cropping system

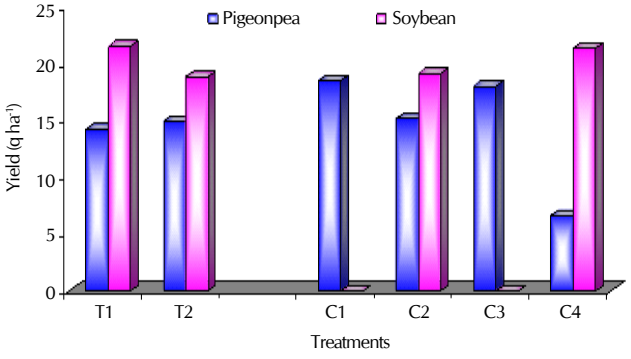

Figure 2: Seed yield as influenced by different treatments

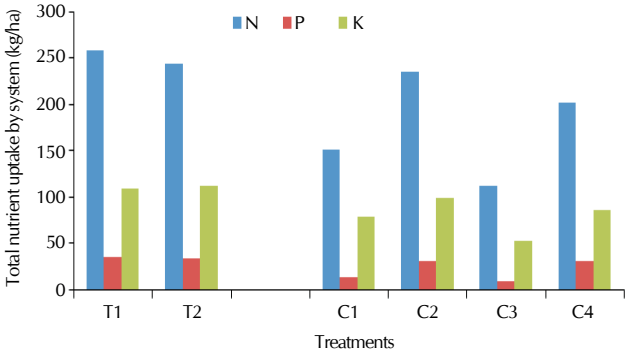

Figure 3: Total N, P and K uptake by intercropping system (kg/ha) as influenced by different treatments

organic carbon thus create favourable environment to soil microbial population. Due to favourable environment yield in intercropping system of pigeonpea + soybnean (1:2) was similar to sole pigeonepa. Due to different growth habit there is no competition was found in pigeonpea, soybean and sunnhemp intercropping system. So, yield in intercropping system of pigeonpea + sunnhemp was similar to sole pigeonpea. The seed yield was contributed from plant growth, higher number of pods per plant in this system and better utilization of all natural resources under pigeonpea + soybean (1:2) system. These results are conformity with Dubey *et al.* (1991), Joshi *et al.* (1994), Paslawar *et al.*(1997), Dudhade *et al.* (2002), Jagtap and Holkar (1995), Sai Sarvan *et al.* (2014), and Kumar, *et al.* (2015).

Effect on nutrient uptake

Tillage did not showed any influence on on NPK uptake however numerically higher value of NPK uptake by pigeonpea

were found in minimum tillage whereas in case of soybean it was observed in conventional tillage . Total NPK uptake by system were higher in conventional tillage whereas total k uptake was higher in minimum tillage. Significantly higher value of NPK uptake by pigeonpea were found in sole pigeonpea (151.71kg/ha) which were followed by pigeonpea + sunhemp(1:2)(113.36kg/ha), pigeonpea + soybean (1:2) (94.93kg/ha) and lowest in pigeonpea + soybean (1:5) (38.04kg/ha). Highest NPK uptake by system was found in pigeonpea + soybean(1:2) followed by pigeonpea + soybean (1:5) and lowest in pigeonpea + sunnhemp(1:2). Due to favourble environment created by intercropping system leads to improved soil phyco-chemical and biological properties of soil as compared to sole pigeonpea. This leads to higher NPK nutrient uptake by system in pigeonpea + soybean (1:2) over the sole pigeopea. Higher microbial population in soil increased the higher nutrient absorption by intercropping system. Result of nutrient uptake shows the superiority of intercropping system over the sole pigeonpea cropping system.

Effect on protein yield

Results of the protein content (%) and protein yield (kg/ha) were not influenced by tillage practices however higher % protein content was found in conventional tillage and protein yield of pigeonpea was higher in minimum tillage and in case of soybean it was higher in conventional tillage. Significantly higher protein content of pigeonpea was observed in pigeonpea + sunehmp(1:2) which were at par with pigeonpea + soybean(1:2) and sole pigeonpea. Significantly highest pigeonpea protein yield was found in sole pigeonpea which was at par with pigeonpea + sunhemp (1:2). As protein content in seed is a function of its N concentration, therefore, higher concentration of N in seed under the superior treatments seems to be the only reason of attaining higher protein content in pigeonpea and soybean (1:2). The total protein yield (kg/ha) by system was maximum with pigeonpea + soybean (1:2) which was similar to pigeonpea + soybean(1:5). Protein yield by sole pigeonpea was similar with pigeonpea + sunhemp (1:2). This shows that pigeonpea + soybean (1:2) was superior over another treatment.

REFERENCES

Benites. J. 2008. Effect of no- tillage on conservation of soil and soil fertility .In; Goddard, T., Zobisch, M.A.Gan , Y.T., Ellis w. Watson, A. sombatpaint, S.(Eds.).No till farming systems. Special publication no. 3. World Association of soil and water conservation , Bangkok, Thailand, pp. 1-554.

DAC. 2014. Agricultural Statistics at a Glance, Directorate of Economics and Statistics, Ministry of Agriculture, Government of India (Website: http://www.dacnet.nic.in/eands).

Derpsch, R., Roth ,C., sidiras, N.,Kopke,U. 1991. Controlde erosao no parana Brazil: Sistemas de cobertura do solo, plantio direto e prepare conservacionista do solo. Deutsche gesellschaft fur Technische Zusammenarbeit (GTZ), TZVerag, Rossdorf Gmbh,Eschborn, Germany.

Dubey, O.P., Garg.,D.C.,Dixit,j. p. and Tiwari,P.K. 1991. Intercropping of short duration pigeonpea. *Indian J.Agronomy*. **38(2):** 253-254.

Hushnal, C. S. and Malik,S. 1988. Assessment of yield advantages in intercropping system. *J. Maharashtra Agricultural Universities*. **13:** 56-58

Jagtap , J. G. and Holkar S. 1995. Soybean + pigeonpea – remunerative intercropping system for Malwa region of Madhya Pradesh. *International chickpea and pigeonpea news letter*. 1995. **(2):** 63-64.

Joshi, O. P., Bhatia ,V. S. And Bundela,V. P. S 1994. Performance of soybean – pigeonpea intercropping system in Malwa plateau of Madhya Pradesh. *J. Oilseeds Research*. **11:** 189-192.

Paslawar, A. N., Thakare,K. K. And Pund,G. H. 1997. Parallel cropping of soybean with pigeonpea under rainfed conditions. *J. Soils and Crops*. **7:** 210-212.

Kumar, R., Paslawar, A. N., Singh, U. and Nagar, R. K. 2015. Effect of conservation tillage on growth, production and energetic of pigeonpea based intercropping system under rainfed. *The Bioscan*. **9(1&2):** 153-157.

Sai Sarvan, U. and Ramanmurthy, K. V. 2014. Diverification of rice (Oryza sativa. L.) based cropping system for higher production in north coastral zone of Andhrapradesh. *The Bioscan*. **9(4):** 1485-1490.

Satish Kumar, R. C., Singh, and Kadian,V. S. 2003. Production potential of pigeonpea (*Cajanus cajan*) and greengram (*Phaseolus radiatus*) intercropping patterns in semi-arid tract of Haryana. *Indian J. Agronomy*. **48:** 259-262.