International Journal of Agricultural Sciences
Volume **11** | Issue 1 | January, 2015 | 68-72 ■ e ISSN-0976-5670
☞ **DOI: 10.15740/HAS/IJAS/11.1/68-72**
Visit us : *www.researchjournal.co.in*

RESEARCH PAPER

Soil fertility and uptake as influenced by different intercropping in summer pearlmillet (*Pennisetum glaucum* L.)

B.L. YADAV*, B.S. PATEL[1] **AND** S.K. YADAV[2]
Department of Agronomy, C.P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, SARDARKRUSHINAGAR (GUJARAT) INDIA

Abstract : A field experiment was conducted during the summer season 2010 at Agronomy Instructional Farm, Department of Agronomy, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar (Gujarat) to study on intercropping in summer pearlmillet [*Pennisetum glaucum* (L.) R. Br. Emend. Stuntz]. Thirteen treatments of sole crops and intercropping systems *viz.*, T_1: pearlmillet sole, T_2: cowpea sole, T_3: greengram sole, T_4: mothbean sole, T_5: sesame sole, T_6: pearlmillet + cowpea (1:1), T_7: pearlmillet + cowpea (1:2), T_8: pearlmillet + greengram (1:1), T_9: pearlmillet + greengram (1:2), T_{10}: pearlmillet + mothbean (1:1), T_{11}: pearlmillet + mothbean (1:2), T_{12}: pearlmillet + sesame (1:1) and T_{13}: pearlmillet + sesame (1:2) were evaluated in a Randomized Block Design with three replications. The soil was loamy sand, neutral (pH 7.0) low in organic carbon (0.17%), available nitrogen (149 kg N/ha), medium in available phosphorus (46 kg P_2O_5/ha) and high in potassium (281 kg K_2O/ha). The higher available nitrogen, phosphorus and potassium were observed in pulses sole and intercropping systems. Green gram sole established its superiority by recording available nitrogen, phosphorus and potassium. Intercropping of cowpea, greengram, mothbean and sesame at 1:1 and 1:2 row ratios in pearlmillet recorded significantly higher N, P and K content (%) of pearlmillet. While, in case of N content (%) found significantly higher in intercrops when grown as sole crop, but P and K content (%) found higher in intercropping systems. Maximum total N, P and K uptake of pearlmillet was recorded under sole crop, though when pearlmillet crop intercropped with pluses and sesame crop. All intercrops sown as sole crop recorded higher total N, P and K uptake as compared to intercropped in pearlmillet.

Key Words : Pearlmillet, Cowpea, Greengram, Mothbean, Sesame, Cropping system,

View Point Article : Yadav, B.L., Patel, B.S. and Yadav, S.K. (2015). Soil fertility and uptake as influenced by different intercropping in summer pearlmillet (*Pennisetum glaucum* L.). *Internat. J. agric. Sci.,* **11** (1): 68-72.

Article History : Received : 28.05.2014**; Revised :** 07.11.2014**; Accepted :** 24.11.2014

INTRODUCTION

Pearlmillet [*Pennisetum glaucum* (L.) R. Br. Emend. Stuntz] belongs to Gramineae family. It is one of the most important food grain cereal crops of India and ranks fourth in area after rice, wheat and sorghum. It is one of the major cereal crop grown in the arid and semi-arid regions of the world. Pearlmillet is mostly spread in Gujarat, Rajasthan, Maharashtra, Madhya Pradesh, Uttar Pradesh and Andhra Pradesh where it is grown comparatively on large scale. Generally, pearlmillet is adapted to stress intensive environment, yet it is highly versatile, input responsive and high quality cereal with great potential to become a valuable component of non-traditional season like summer under irrigated and high input management conditions. Legumes, invariably find a place in the intercropping system with non-legumes and is an easy way to overcome biological constraints

*** Author for correspondence**
[1]AICRP-IFS, Sardarkrushinagar Dantiwada Agricultural University, SARDARKRUSHINAGAR (GUJARAT) INDIA
[2]Department of Horticulture, C.P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, SARDARKRUSHINAGAR (GUJARAT) INDIA

and ameliorate soil fertility (Biswas, 1982; Patil and Pal, 1988).

Intercropping means growing of subsidiary crops between two widely spaced of main crop. The main objective of intercropping is to utilize the space left between two rows of main crop and to produce more grain per unit area. The basic concept of intercropping system involves growing together two or more crops with the assumption that two crops can exploit the environment better than one and ultimately produce the higher yield (Reddy and Willy, 1981) because the component crops differ in resources use and when grown together they complement each other and make overall better use of resources. This practice leads to some benefit like yield advantages as compared to sole cropping, greater stability of yield over different seasons, insurance against aberrant weather conditions, build-up or maintenance of soil fertility, economy of land, production of higher yield and higher economic returns in a given season.

MATERIAL AND METHODS

A field experiment was conducted during the summer season 2010 at Agronomy Instructional Farm, Department of Agronomy, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar (Gujarat) to study on intercropping in summer pearlmillet [*Pennisetum glaucum* (L.) R. Br. Emend. Stuntz] in Randomized Block Design with 13 treatments (Table 1), replicated three times. The soil was loamy sand, neutral (pH 7.0) low in organic carbon (0.17%), available nitrogen (149 kg N/ha), medium in available phosphorus (46 kg P_2O_5/ ha) and high in potassium (281 kg K_2O/ha). The recommended fertilizer schedule (120, 60 and 00 kg N, P_2O_5 and K_2O/ha) was followed both for sole and intercropping systems. Recommended cultivars like 'GHB 558' of pearlmillet, 'GC 5' of cowpea, 'GM 4' of greengram, 'GM 2' of mothbean and 'GT 2' of sesame were used in the experiment. The final plant-to-plant distance in pearlmillet was maintained at 15 cm. Intercrops planted in inter-rows of pearlmillet were also thinned to keep the plant-to-plant distance at 15 cm in cowpea, greengram, mothbean and sesame, respectively. There was no rainfall during crop growth period as well as no severe attack of insect and pest on the base of visual observation. Initial composite soil sample was drawn from 0-15 cm soil depth before sowing of the experimental crop for the year of study. Soil samples were also drawn (0-15 cm depth) from each plot of all the replications after the harvest of crop seasons. The soil samples were air dried, powdered and then sieved through a 2 mm mesh and used for analysis. All soil samples collected for chemical analysis were used to determine nitrogen, available phosphorus and available potash following the method suggested by Jackson (1967). Representative plant samples were collected from each net plot for chemical analysis. They were oven dried at 70^0C for 24 hours. Thereafter, the plant parts such as straw (pearlmillet), haulm (cowpea, greengram and mothbean) and straw (sesame) or grains (pearlmille), seeds (cowpea, greengram, mothbean and sesame) were separated and individually powdered by mechanical grinder. This powder was used for the estimation of N, P and K. The total nitrogen was estimated by micro Kjeldhal's method (Nknong and Bullance, 1982). While, for phosphorus and potash, the powdered samples were digested in ternary acid mixture as per the method described by Johnson and Ulrich (1969). From this acid extract, phosphorus was estimated by ammonium vanadomolybdates method and potash by flame photometer method (Jackson, 1967). The uptake of N, P and K was calculated by using following equation :

$$\text{Uptake (kg/ha)} = \frac{\text{Content (\%)} \times \text{Yield}}{100}$$

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads :

Effect of intercrops on pearlmillet :

Significantly higher grain and straw yields were recorded by sole pearlmillet than rest of the intercropping treatments, which could be attributed to higher and optimum plant densities in sole cropping system. Lower significant grain and straw yields were noticed under pearlmillet with cowpea, greengram, mothbean and sesame at 1:2 row ratio intercropping system (Table 1).

This might be due to lower plant densities of pearlmillet and also higher competition offered by intercrops for natural resources like space, plant nutrient, moisture and incoming sun radiation. The results corroborate with the finding of Yadav and Yadav (2001); Baldevram *et al*. (2005); Kumar *et al*. (2006) and Choudhary (2009).

Effect of pearlmillet on intercrops :

Seed and haulm yield per hectare of cowpea, greengram, mothbean and sesame were reduced in intercropping systems in comparison to their respective sole cropping systems. Such variation could be ascribed due to decrease in plant densities when grown as intercrops with pearlmillet and higher competition among pearlmillet and intercrops for natural resources like soil moisture, plant nutrient, space and sunlight responsible for higher photosynthesis rate resulting lower accumulation of dry matter per plant in comparison of sole crop. These results are supported by Yadav and Yadav (2001); Kumar *et al.* (2006) and Choudhary (2009).

Effect of soil status :

The sole crop and inter cropping systems exerted their non-significant effect on available nitrogen, phosphorus and potassium after harvest. The higher available nitrogen,

Table 1 : Soil fertility and nutrient content (%) as influence by different sole and intercropping treatments

Treatments	Grain/ yields (kg/ha)	Straw/ haulm /stover yields (kg/ha)	Nutrient status in soil after harvest			Nitrogen content (%)		Phosphorus content (%)		Potassium content (%)	
			N	P	K	Seed	Straw	Seed	Straw	Seed	Straw
Initial	–	–	165.8	41.6	280.7	–	–	–	–	–	–
T_1 : Pearlmillet sole	3854	8748	145.6	40.2	277.1	1.56	0.55	0.42	0.24	0.67	0.83
T_2 : Cowpea sole	1181	1973	167.9	41.9	282.6	3.73	1.51	0.45	0.39	0.62	0.76
T_3 : Greengram sole	1250	2051	172.1	42.4	284.2	3.80	1.56	0.35	0.25	0.55	0.67
T_4 : Mothbean sole	885	1478	168.3	42.0	283.2	3.71	1.58	0.36	0.28	0.56	0.71
T_5 : Sesame sole	296	1258	148.2	40.7	279.3	1.72	0.54	0.39	0.26	0.66	0.86
T_6 : Pearlmillet + cowpea (1:1)	2368	5045	160.4	40.9	280.5	1.58	0.58	0.43	0.23	0.71	0.91
	(467)	(878)				(3.63)	(1.57)	(0.47)	(0.39)	(0.65)	(0.83)
T_7 : Pearlmillet + cowpea (1:2)	2079	3847	162.7	41.3	281.9	1.60	0.59	0.45	0.26	0.75	0.95
	(630)	(1122)				(3.67)	(1.60)	(0.48)	(0.40)	(0.63)	(0.79)
T_8 : Pearlmillet + greengram (1:1)	2445	5355	167.2	41.5	282.7	1.60	0.58	0.44	0.25	0.73	0.84
	(485)	(926)				(3.71)	(1.54)	(0.37)	(0.27)	(0.57)	(0.72)
T_9 : Pearlmillet + greengram (1:2)	2248	4428	169.3	42.0	283.8	1.62	0.59	0.43	0.27	0.77	0.93
	(695)	(1188)				(3.76)	(1.57)	(0.38)	(0.28)	(0.58)	(0.72)
T_{10} : Pearlmillet + mothbean (1:1)	2353	4965	162.2	41.0	280.4	1.59	0.58	0.42	0.26	0.76	0.90
	(307)	(599)				(3.62)	(1.53)	(0.38)	(0.31)	(0.58)	(0.75)
T_{11} : Pearlmillet + mothbean (1:2)	2073	3981	164.5	41.6	282.3	1.60	0.59	0.44	0.28	0.69	0.83
	(465)	(818)				(3.67)	(1.54)	(0.40)	(0.33)	(0.59)	(0.74)
T_{12} : Pearlmillet + sesame (1:1)	2298	4710	151.2	40.8	279.5	1.53	0.55	0.46	0.29	0.68	0.84
	(69)	(336)				(1.52)	(0.55)	(0.41)	(0.28)	(0.68)	(0.88)
T_{13} : Pearlmillet + sesame (1:2)	2044	3618	155.8	40.9	279.9	1.61	0.70	0.45	0.28	0.70	0.88
	(102)	(467)				(1.58)	(0.57)	(0.43)	(0.30)	(0.65)	(0.84)
S.E. ±	158	326	7.0	2.1	15.8	0.06	0.03	0.02	0.01	0.03	0.04
C.D. (P=0.05)	460	950	NS	NS	NS	NS	NS	NS	0.03	NS	NS
C. V. (%)	11.28	11.35	7.53	8.66	9.70	6.02	7.56	6.77	6.61	7.22	7.38

* Data presented in parenthesis indicates intercrops values NS= Non-significant

Table 2 : Nutrient uptake (kg/ha) as influence by different sole and intercropping treatments

Treatments	Nitrogen uptake (kg/ha)			Phosphorus uptake (kg/ha)			Potassium uptake (kg/ha)		
	Seed	Straw	Total	Seed	Straw	Total	Seed	Straw	Total
T_1 : Pearlmillet sole	59.93	56.92	116.86	16.19	21.00	37.18	25.82	72.68	98.50
T_2 : Cowpea sole	44.10	31.74	75.84	5.32	7.65	12.97	7.32	15.05	22.37
T_3 : Greengram sole	47.54	31.95	79.49	4.38	5.13	9.50	6.88	13.65	20.52
T_4 : Mothbean sole	32.87	23.36	56.22	3.19	4.14	7.32	4.96	10.43	15.38
T_5 : Sesame sole	5.11	8.10	13.11	1.15	3.27	4.43	1.95	10.88	12.83
T_6 : Pearlmillet + cowpea (1:1)	37.36 (16.95)	34.45 (13.80)	71.82 (30.75)	10.18 (2.19)	11.79 (3.47)	21.97 (5.66)	16.82 (3.04)	45.85 (7.25)	62.66 (10.28)
T_7 : Pearlmillet + cowpea (1:2)	33.30 (23.11)	26.44 (17.96)	59.75 (41.07)	9.36 (3.03)	10.06 (4.45)	19.42 (7.48)	15.60 (3.97)	36.63 (8.84)	52.22 (12.81)
T_8 : Pearlmillet + greengram (1:1)	39.01 (17.99)	36.35 (14.26)	75.36 (32.24)	10.76 (1.79)	13.39 (2.50)	24.15 (4.30)	17.85 (2.76)	44.89 (6.65)	62.74 (9.42)
T_9 : Pearlmillet + greengram (1:2)	36.36 (26.10)	30.35 (18.67)	66.71 (44.77)	9.67 (2.64)	11.83 (3.33)	21.49 (5.97)	17.31 (4.03)	41.11 (8.55)	58.42 (12.58)
T_{10} : Pearlmillet + mothbean (1:1)	37.39 (11.13)	33.69 (9.15)	71.07 (20.28)	9.88 (1.17)	13.03 (1.86)	22.92 (3.02)	17.88 (1.78)	44.89 (4.48)	62.78 (6.26)
T_{11} : Pearlmillet + mothbean (1:2)	33.15 (17.05)	27.43 (12.60)	60.58 (29.65)	9.12 (1.86)	11.10 (2.70)	20.22 (4.56)	14.31 (2.74)	33.19 (6.04)	47.50 (8.78)
T_{12} : Pearlmillet + sesame (1:1)	35.22 (1.05)	30.46 (1.86)	65.68 (2.90)	10.57 (0.28)	13.89 (0.94)	24.46 (1.22)	15.62 (0.47)	39.40 (2.97)	55.02 (3.44)
T_{13} : Pearlmillet + sesame (1:2)	32.86 (1.61)	25.18 (2.66)	58.05 (4.27)	9.20 (0.44)	10.11 (1.40)	19.31 (1.84)	14.31 (0.66)	31.65 (3.92)	45.96 (4.58)
S. E. ±	1.36	1.40	2.54	042	0.47	0.94	0.69	1.78	2.40
C.D. (P=0.05)	3.96	4.09	7.42	1.22	1.39	2.74	2.01	5.19	7.01
C. V. (%)	6.14	7.26	6.14	6.87	6.37	6.93	6.91	7.11	6.86

* Data presented in parenthesis indicates intercrops values

phosphorus and potassium was observed in pulses sole and intercropping systems. Greengram sole established its superiority by recording available nitrogen, phosphorus and potassium. However, it was closely followed by pearlmillet + greengram (1:2), mothbean sole, cowpea sole and pearlmillet + greengram (1:1), respectively. The lowest available nitrogen, phosphorus and potassium was recorded under pearlmillet sole after harvest (Table 1).

Effect of nutrient content (%) :

The sole crop and intercropping systems exerted their non-significant effect on nitrogen, phosphorus and potassium content (%) in seed and straw. The higher nitrogen content (%) was observed in pearlmillet + sesame (1:2) and phosphorus was observed in pearlmillet + sesame(1:1) and potassium was observed in pearlmillet + greengram (1:2), respectively, while lowest with nitrogen content (%) in seed and straw with T_{12} pearlmillet + sesame (1:1), phosphorus and potassium content (%) in seed and straw with pearlmillet sole, respectively (Table 1).

The effect on nitrogen content (%) in seed and haulm higher in sole greengram and phosphorus and potassium content (%) higher in seed and haulm of all intercrops were increased in intercropping systems as compared to their sole cropping (Table 1).

Effect of uptake by the crops (kg/ha) :

The sole crop and intercropping systems exerted their significant effect on total nitrogen, phosphorus and potassium uptake by crops (kg/ha). The higher total nitrogen, phosphorus and potassium uptake by crops (kg/ha) was observed in pearlmillet sole. While, lowest total nitrogen, phosphorus and potassium uptake by crops (kg/ha) was observed pearlmillet + sesame (1:2) (Table 2). These results are in conformity with findings of Goswami *et al.* (2002).

The effect on total nitrogen, phosphorus and potassium uptake by crops (kg/ha) higher in sole crops were reduced in intercropping systems as compared to their sole cropping (Table 2).

REFERENCES

Baldevram, Chaudhary, G.R., Jat, A.S. and Jat, M.L. (2005). Effect of integrated weed management and intercropping system on growth and yield of pearlmillet. *Indian J. Agron.*, **50**(3) : 210-213.

Biswas, T.D. (1982). Management of soil physical conditions for soil productivity. *J. Indian Soc. Soil. Sci*., **30** : 427-440.

Choudhary, R.A. (2009). Intercropping in pearlmillet [*Pennisetum glaucum* (L.) R. Br. Emend. Stuntz] with pluse crops in rainfed conditions. M.Sc. (Ag.) Thesis, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, GUJARAT (INDIA).

Goswami, V.K., Kaushak, S.K. and Gautam, R.C. (2002). Effect of intercropping and weed control on nutrient uptake and water use efficiency of pearlmillet (*Pennisetum glaucum*) under rainfed conditions. *Indian J. Agron.,* **47**(4) : 504-508.

Jackson, M.L. (1967). *Soil chemical analysis.* Prentice Hall of India Pvt. Ltd., New Delhi, 327-350pp.

Johnson, C.M. and Ulrich, A. (1969). California Agricultural Experimental Statistics Bulletin. 766pp.

Kumar, R., Hooda, R.S., Singh, H. and Nanwal, R.K. (2006). Performance of intercropping and strip cropping systems of pearlmillet- legume association. *Indian J. Agric. Sci.,***76**(5):319-321.

Nknong, G. and Bullance, M.G. (1982). A sensitive colorimetric procedure for nitrogen determination in Micro Kjeldhal's digest. *J. Agric. Food Chem.,* **30** (3) : 416-420.

Patil, B.P. and Pal, M. (1988). Influence of pearlmillet + legume intercropping system on physico-chemical properties of soil. *Indian J. Agron.*, **33**(4) : 389-392.

Reddy, M.S. and Willy, R.W. (1981). Growth and resource use studies in an intercrop of pearlmillet/groundnut. National symposium. Indian Society of Agronomy, CSSRI, Karnal. 3-5 April, 1980, NEW DELHI, INDIA.

Yadav, R.S. and Yadav, O.P. (2001). The performance of cultivar of pearlmillet and clusterbean under sole cropping and intercropping systems in arid zone conditions in India. *Exp. Agric.*, **37**(2): 231-240.