Agric. Sci. Digest., 38(4) 2018: 275-279
Print ISSN:0253-150X / Online ISSN:0976-0547

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
www.arccjournals.com

Yield and economics of pigeon pea based intercropping systems as influenced by different land configurations

H.S. Garud, B.V. Asewar, S.U. Pawar* and I.A.B. Mirza

AICRP on Dryland Agriculture,
Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani-431 402, Maharashtra, India.
Received: 08-04-2018 Accepted: 25-10-2018 DOI: 10.18805/ag.D-4741

ABSTRACT

A field experiment was conducted at experimental farm of AICRP for Dry Land Agriculture, V.N.M.K.V., Parbhani during *kharif* season of 2015-16 and 2016-17 to study yield and economics of pigeon pea based intercropping systems as influenced by different land configurations. Soil of experimental field was medium deep black with low in available nitrogen, medium in available phosphorus and high in available potassium. The experiment was laid out in split plot design with three main plot treatments and four sub plot treatments. The main plot treatments were three land configurations as (L_1) Broad bed furrow (BBF), (L_2) Ridges and furrow and (L_3) Flat bed method. Sub plot treatments were four intercropping systems i.e. (I_1) pigeon pea + soybean (2:1), (I_2) pigeon pea + greengram (2:1), (I_3) pigeon pea + black gram (2:1) and (I_4) pigeon pea + Cowpea (2:1). The highest pigeon pea equivalent yield and net returns of Rs. 67814 ha^{-1} were obtained with broad bed furrow (L_1), which was closely followed by treatment L_2 (ridges and furrow) with net returns of Rs. 64095 ha^{-1}. Among intercropping systems the highest pigeon pea equivalent yield and net returns of Rs. 68908 ha^{-1}were obtained in pigeonpea+greeengram (2:1) intercropping system and was followed by pigeonpea+blackgram and pigeonpea+soybean intercropping system.

Key words: Economics, Intercropping, Land configurations, Pigeonpea, Yield.

INTRODUCTION

In Maharashtra the area under pigeonpea was 1.53 million hectares with production of 1.17 million tonnes and average productivity of 764 kg ha^{-1} and in Marathwada the area is 5.3 lakh hectares with production of 1.3 lakh tonnes (Anonymous, 2016).

The initial slow growth rate and deep root system of pigeonpea offers a good scope for intercropping with fast growing early maturing and shallow rooted crops (Ramamoorthy *et al.*2004). Intercropping with short duration pulses (greengram and blackgram) and oilseeds in pigeonpea enhances total productivity besides the benefits of suppressing weed and spreading the risk involved (Sarma *et al.*1995). To stabilize crop production and to provide insurance against aberrant weather situation, intercropping could be a viable agronomic means of risk minimizing, more profit and subsistence oriented, energy efficient and sustainable venture (Faroda *et al*. 2007).

Among the abiotic stresses, moisture deficiency as well as moisture excess or water logging conditions during wet season create unfavourable environment for nodulation, and nutrient uptake and favourable conditions for disease incidence, finally leading to reduced crop stand. Moisture deficiency in the post-monsoon period adversely affects the development of reproductive organs leading to depressed yields. Hence, efficient utilization of rain water play an important role. This can be enhanced by means of various land configuration practices. These practices reduces runoff thereby store more soil moisture. Water logging condition hampers nodulation, enhance incidence of diseases leading to complete crop failure in heavy rainfall areas. To avoid these problems modified land configuration such as broad bed and furrows has been advocated (Desai *et al*. 2000).

Keeping these points in mind an experiment was conducted to study the performance of intercropping system with short durational legumes soybean, greengram, blackgram and cowpea as intercrops with pigeon pea in 2:1 ratio under different land configurations.

MATERIALS AND METHODS

The field experiments were conducted at Research Farm, AICRP for Dryland Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *kharif* seasons of 2015-16 and 2016-17.

The experiment was laid out in split plot design with three replications. The present investigation consists of 12 treatment combinations comprising of three land configurations in main plot and four intercropping systems in sub plots. The treatments were allotted randomly in each replication. The trials were conducted during *kharif* 2015 and 2016.

*Corresponding author's e-mail: pawarsu7@rediffmail.com

The main plot treatments comprised of three Land configurations L_1 – Broad bed furrow (BBF), L_2 - Ridges and furrow, L_3 - Flat bed method while the sub plot comprised of four intercropping systems *viz.* I_1 - pigeonpea + soybean (2:1), I_2 - pigeonpea + green gram (2:1), I_3 - pigeonpea + black gram (2:1), I_4 - pigeonpea + cowpea (2:1).

During first year 2015-16, onset of monsoon was started from 23rd SMW and continued up to 40th SMW with total quantity of rainfall received was 408.01 mm, which was 46.10 per cent deficit of normal rainfall during the year. Pigeonpea and intercrops were sown by dibbling on 27th June 2015 during the 30th SMW. During 31st, 32nd and 33rd SMW, 69.6 mm rainfall was received which good for the crop growth. There was dryspell during 26-28th SMW.

During second year 2016-17, rains started from 23rd SMW and continued till 41st SMW with total quantity of 1126.7 mm, which was 27.31 per cent excess as compared to normal rainfall. Total numbers of rainy days were 68. Pigeonpea and intercrops were sown by dibbling on 02nd July 2016 during the 27th SMW, except 32nd SMW, all the meteorological week in *kharif* season contributed in rainfall.

The fertilizers were applied as per recommended dose *i.e.*, 25: 50:00 (N: P: K) kg ha^{-1}. Pigeonpea was leguminous crop; full dose of fertilizer was applied as basal dose. The sources of nutrients were urea (46% N), Single super phosphate (16% P_2O_5).

Plant protection measures were undertaken as and when the population of pest incidence reached to ETL in the field. For protection against pests different insecticides was sprayed whenever the attack of pests occurred.

Five plants were selected from each net plot randomly and those selected plants were tagged for recording biometric observations at various stages of crop growth. The experimental data obtained on various selected variables were analyzed by the standard method of statistical analysis (Panse and Sukhatme, 1967) for split plot design.

RESULTS AND DISCUSSION

Pigeonpea equivalent yield: The pigeonpea equivalent yield and economics of pigeonpea were influenced significantly due to different treatments.

It was observed that mean equivalent yield was 1436, 1895 and 1666 kg ha^{-1} in 2015-16, 2016-17 and in pooled analysis. (Table 1).

Effect of land configurations: The data indicated that pigeonpea equivalent yield (kg ha^{-1}) was influenced significantly due to land configuration treatments during both the year and in pooled data. (Table 1).

The land configuration treatment of broad bed furrow (L_1) recorded higher pigeonpea equivalent yield of 1595, 2051 and 1823 kg ha^{-1} during 2015-16, 2016-17 and in pooled data, respectively and found significantly superior over flat bed (L_3) but it was found at par with treatment ridges and furrow (L_2) during both the year and in pooled analysis.

The probable reason behind increase in seed yield might be due to more favoured overall growth and yield attributing characters due to favourable seed bed, better aeration, scope for light interception, benefit of more conserved moisture in furrows and its support at critical growth stages like flowering, pod initiation and development. As well as due to better soil and plant conditions provided by broad bed furrow leading to increase in growth and yield parameters. Finally this resulted in higher values of yield attributing characters and which in turn resulted in higher yields. The results obtained thus correlates with earlier findings of Mandal *et al.* (2013) and Mankar *et al.* (2013).

Table 1: Pigeonpea equivalent yield (kg ha^{-1}) as influenced by different treatments during 2015-16, 2016-17 and in pooled analysis.

Treatments	Pigeonpea equivalent yield (kg ha^{-1})		
	2015-16	**2016-17**	**Pooled mean**
Land configurations (L)			
L_1- Broad bed furrow	1595	2051	1823
L_2- Ridges and furrow	1517	2000	1759
L_3- Flat bed	1197	1635	1416
S.E. ±	28.28	53.23	43.41
C.D. at 5 %	83.92	157.93	126.34
Intercropping systems (I) (2:1)			
I_1 – Pigeonpea+soybean	1425	1900	1663
I_2 – Pigeonpea+greengram	1579	2084	1832
I_3 – Pigeonpea+blackgram	1432	1896	1664
I_4 – Pigeonpea+cowpea	1309	1701	1505
S.E. ±	37.82	59.02	48.41
C.D. at 5 %	112.21	175.11	140.39
Interaction (L x I)			
S.E. ±	65.51	102.24	83.62
C.D. at 5 %	NS	NS	NS
General mean	**1436**	**1895**	**1666**

Effect of intercropping systems: The pigeonpea equivalent yield was influenced significantly due to different intercropping systems. Pigeonpea equivalent yield by greengram found significantly superior over pigeonpea equivalent yield by blackgram, soybean and cowpea during 2015-16, 2016-17 and in pooled analysis.

Pigeonpea equivalent yield by cowpea recorded significantly lowest during both the year and in pooled analysis. These results were in line with those reported by Jain *et al.*, (2001).

Interaction effect: The mean pigeonpea equivalent yield was not influenced significantly due to interaction between land configuration and intercropping systems during both the years of experimentation and in pooled data.

Gross monetary returns (Rs ha^{-1}): It was observed that higher gross returns (99189 ₹ ha^{-1}) were recorded during 2016-17 than the year 2015-16 (75226 ₹ ha^{-1}).

Effect of land configurations : The gross monetary returns differed significantly due to land configuration treatment during both the year and in pooled analysis where in land configuration treatment of broad bed furrow (L_1) recorded higher gross monetary returns of Rs 83478, Rs 107180 and Rs 95352 ha^{-1} during 2015-16, 2016-17 and in pooled data, respectively and found significantly superior over flat bed (L_3) but it was found at par with treatment ridges and furrow (L_2) during both the year and in pooled analysis. (Table 2).

Effect of intercropping systems: The gross monetary returns were influenced significantly due to different

Table 2: Gross monetary returns (Rs. ha^{-1}) as influenced by different treatments during 2015-16, 2016-17 and in pooled analysis.

Treatments	Gross monetary returns (Rs. ha^{-1})		
	2015-16	**2016-17**	**Pooled mean**
Land configurations (L)			
L_1- Broad bed furrow	83478	107180	95352
L_2- Ridges and furrow	79426	104660	92013
L_3- Flat bed	62877	85783	74330
S.E. ±	1450.6	2713.8	2080.4
C.D. at 5 %	4303.4	8050.7	5825.1
Intercropping systems (I) (2:1)			
I_1 – Pigeonpea+soybean	74733	99536	87135
I_2 – Pigeonpea+greengram	82594	108890	95744
I_3 – Pigeonpea+blackgram	75034	99240	87137
I_4 – Pigeonpea+cowpea	68683	89085	78884
S.E. ±	1915.4	2990.5	2451.1
C.D. at 5 %	5682.2	8871.6	6863.1
Interaction (L x I)			
S.E. ±	3317.5	5179.7	4268.4
C.D. at 5 %	NS	NS	NS
General mean	**75226**	**99189**	**87225**

Table 3: Net monetary returns (Rs. ha^{-1}) as influenced by different treatments during 2015-16, 2016-17 and in pooled analysis.

Treatments	Net monetary returns (Rs. ha^{-1})		
	2015-16	**2016-17**	**Pooled mean**
Land configurations (L)			
L_1- Broad bed furrow	55976	79652	67814
L_2- Ridges and furrow	51524	76666	64095
L_3- Flat bed	36575	59449	48012
S.E. ±	1450.6	2712.8	2080.9
C.D. at 5 %	4303.4	8047.8	5826.6
Intercropping systems (I) (2:1)			
I_1 – Pigeonpea+soybean	46808	71580	59194
I_2 – Pigeonpea+greengram	55774	82043	68908
I_3 – Pigeonpea+blackgram	48214	72389	60302
I_4 – Pigeonpea+cowpea	41303	61677	51490
S.E. ±	1915.4	2989.8	2451.8
C.D. at 5 %	5682.2	8869.6	6865.2
Interaction (L x I)			
S.E. ±	3317.5	5178.5	4247.20
C.D. at 5 %	NS	NS	NS
General mean	**48025**	**71922**	**59973**

Table 4: Mean benefit cost ratio as influenced by different treatments during 2015-16, 2016-17 and in pooled analysis.

Treatments	B : C ratio		
	2015-16	2016-17	Pooled mean
Land configurations (L)			
L_1- Broad bed furrow	2.03	2.89	2.46
L_2- Ridges and furrow	1.84	2.74	2.29
L_3- Flat bed	1.39	2.26	1.82
S.E. ±	0.005	0.009	0.007
C.D. at 5 %	0.015	0.028	0.020
Intercropping systems (I) (2:1)			
I_1 – Pigeonpea+soybean	1.67	2.55	2.11
I_2 – Pigeonpea+greengram	2.07	3.05	2.56
I_3 – Pigeonpea+blackgram	1.79	2.68	2.24
I_4 – Pigeonpea+cowpea	1.50	2.24	1.87
S.E. ±	0.0071	0.010	0.009
C.D. at 5 %	0.021	0.032	0.025
Interaction (L x I)			
S.E. ±	0.012	0.018	0.015
C.D. at 5 %	NS	NS	NS
General mean	**1.75**	**2.63**	**2.19**

intercropping systems. Intercropping system pigeonpea +greengram recorded highest gross monetary returns of Rs 82294, Rs 108890 and Rs 95744 ha^{-1} during the year 2015-16, 2016-17 and in pooled analysis, respectively and it was significantly higher over the other intercropping systems (Table2). Similar findings were reported by Srivastava *et al.* (2004).

Net monetary returns (Rs ha^{-1}): It was observed that higher net returns (Rs 71922 ha^{-1}) were recorded during 2016-17 than the year 2015-16 (Rs 48025 ha^{-1}).

Effect of land configurations: The net monetary returns differed significantly due to land configuration treatment during both the year and in pooled analysis. Land configuration treatment of broad bed furrow (L_1) recorded significantly higher net monetary returns of 55976, 79652 and 67814 Rs. ha^{-1} during 2015-16, 2016-17 and in pooled data, respectively and found significantly superior over flat bed (L_3) but it was found at par with treatment ridges and furrow (L_2) during 2016-17 and in pooled analysis Table 3. Similar trend was observed in case of benefit cost ratio Table 4.

Effect of intercropping systems: The net monetary returns (Rs ha^{-1}) was influenced significantly due to different intercropping systems. Intercropping system pigeonpea +greengram recorded highest net monetary returns of 55744, 82043 and 68908 Rs. ha^{-1} during the year 2015-16, 2016-17 and in pooled analysis, respectively and it was significantly higher over the other intercropping systems. The benefit cost ratio showed similar trend as that of net monetary returns. The increase in gross return, net return and B: C ratio might be due to better growth and yield attributes in higher seed yield of pigeonpea and higher price of greengram. Sharma *et al*., (2012) and Lewade (2017) also reported similar results.

Interaction effect: The net monetary returns (Rs ha^{-1}) and benefit cost ratio were not influenced significantly due to interaction of land configuration and intercropping systems during both the years and in pooled data.

REFERENCES

Anonymous. (2016). First advance estimated released on 14/09/2016 by Directorate of Economic and Statistics, Department of Agriculture and Cooperation.

Desai, N. C., Ardeshna, R.B. and Intwala, C. G. (2000). Incresing pigeonpea productivity by providing land configuration in vertisols. *International Chickpea and Pigeonpea Newsletter* **7**: 66-67

Faroda, A.S, Joshi, N.L, Singh R. and Saxena A (2007). Resource management for sustainable crop production in arid zone. *Indian J.of Agron* **52**(3) : 181-93.

Giri.G (1990). Studies on pigeonpea and groundnut intercropping under rainfed condition. *Indian J. Agron.*, **35**(4) 446-449.

Jain, H. C., Deshmukh M. R and Duhoon. (2001). Studies on fertilizer management in sesame based intercropping system under rainfed conditions in different agro ecosystems. *J. Oilseeds Res.*, **18** (2): 176-177.

Kumar, P., Rana K.S., and Rana D.S. (2012). Effect of planting systems and phosphorous with bio-fertilizers on the performance of sole and intercropped pigeonpea (*Cajanus cajan*) under rainfed conditions. *Indian Journal of Agronomy.* **57**(2):127-132.

Lewade, A.D. (2017). Effect of land configurations and foliar sprays on soybean (*Glycine max* (L.) Merrill) + pigeonpea (*Cajanus cajan* (L.) Mill sp.) intercropping system under rainfed condition. *M.Sc. (Agri.) Thesis*, VNMKV, Parbhani (M.S.) India.

Mandal, K.G., Hati K.M., Mishra A.K., Bandyopadhyay K.K., and Tripathi A.K.. (2013). Land surface modification and crop diver sification for enhancing productivity of a vertisol. *International Journal of Plant Prpduction*. **7**(3):455-472.

Mankar, D.D. and Nawlakhe S.M. (2013). Effect of land configuration and phosphate management on growth and yield of semi-rabi pigeonpea. *Crop Res.*, **46**(1,2 &3):84-87.

Panse, V.G. and Sukhatme P.V. (1967). Statistical Methods for Agricultural Workers. ICAR, New Delhi.

Ramamoorthy, K., Christopher, A.L. Alagudurai, S. Kandasamy O.S. and Murugappan, V. (2004). Intercropping pigeonpea (*Cajanus cajan*) in finger millet (*Eleusine coracana*) on productivity and soil fertility under rainfed condition. *Indian J. Agron*., **49**, 28-30.

Sharma, A. and Guled M.B. (2012). Effect of set-furrow method of cultivation in pigeonpea + greengram intercropping system in medium deep black soil under rainfed conditions. *Karnataka J. Agric. Sci.*, **25** (1):18-24.

Sarma, N.N. Sarma, D. and Paul, R.(1995). Intercropping of greengram, blackgram and sesame in pigeonpea under different seeding method. *Indian J. Agron*.**40**: 386-387.

Srivastava, K. L. and Jangawad, L. S. (1988). Water balance and erosion rates of Vertisols watersheds under different management *Indian Journal of Dry land Agricultural Research and Development*, **3** (2):137-144.