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Megharani
Department of Agronomy
Zonal Agricultural Research Station, Aland Road, Kalaburgi, Karnataka, India

Pandit
Department of Agronomy
Zonal Agricultural Research Station, Aland Road, Kalaburgi, Karnataka, India

S Rathod
Department of Agronomy
Zonal Agricultural Research Station, Aland Road, Kalaburgi, Karnataka, India

BM Dodamani
Department of Agronomy
Zonal Agricultural Research Station, Aland Road, Kalaburgi, Karnataka, India

Devappagouda H Patil
Department of Agronomy
Zonal Agricultural Research Station, Aland Road, Kalaburgi, Karnataka, India

RP Patil
Department of Agronomy
Zonal Agricultural Research Station, Aland Road, Kalaburgi, Karnataka, India

Corresponding Author:
Megharani
Department of Agronomy
Zonal Agricultural Research Station, Aland Road, Kalaburgi, Karnataka, India

Growth, yield and economics of pieonpea as influenced by irrigation levels and cropping systems under drip irrigation

Megharani, Pandit, S Rathod, BM Dodamani, Devappagouda H Patil and RP Patil

Abstract
A field experiment was conducted to study "Growth, yield and economics of pigeonpea as influenced by irrigation levels and cropping systems under drip irrigation" at Zonal Agricultural Research Station, Kalaburagi, during *kharif* 2018-19. The experiment was laid out in split plot design with three replications. The main factors consists of irrigation levels (50%, 75% and 100% CPE) and sub factors consisting of cropping systems (Sole pigeonpea, pigeonpea + greengram (1:2), pigeonpea + blackgram (1:2) and pigeonpea + soybean (1:2). The results revealed that significantly higher growth attributes *viz*., plant height (176.42 cm), number of primary branches (15.04), secondary branches (16.23), leaf area (20.84 dm^2 $plant^{-1}$), LAI (0.58) and TDMP (306.82 g $plant^{-1}$) at harvest and yield attributes *viz.*, number of pods per plant (241.76), pod weight per plant (191.24 g $plant^{-1}$), seed yield per plant (94.79 g $plant^{-1}$), test weight (10.22 g), grain yield (2656 kg ha^{-1}), stalk yield (6431 kg ha^{-1}) and husk yield (2485 kg ha^{-1}) and also higher gross returns (Rs. 226245 ha^{-1}), net returns (Rs. 173435 ha^{-1}) and BC ratio (4.29) were recorded with 75% CPE compared to 50% and 100% CPE. Among the cropping system, sole pigeonpea recorded significantly higher growth attributes *viz*., plant height (183.37 cm), number of primary branches per plant (9.84), number of secondary branches per plant (19.50), leaf area (25.55 dm^2 $plant^{-1}$), LAI (0.71) and TDMP (340.98 g $plant^{-1}$) at harvest and yield attributes *viz.*, number of pods per plant (241.76), pod weight per plant (191.24 g $plant^{-1}$), seed yield per plant (94.79 g $plant^{-1}$), test weight (10.22 g), grain yield (2656 kg ha^{-1}), stalk yield (6431 kg ha^{-1}) and husk yield (2485 kg ha^{-1}) as compared to intercropped pigeonpea. While, pigeonpea + greengram (1:3) intercropping system recorded significantly higher gross returns (Rs. 252400 ha^{-1}), net returns (Rs. 196590 ha^{-1}) and BC ratio (4.52) as compared to sole pigeonpea and other cropping systems.

Keywords: CPE, plant height, LAI, TDMP, grain yield, stalk yield

Introduction
Pulses are commonly grown as rainfed crops all over the Indian plains during rainy months, among the pulses pigeonpea (*Cajanus cajan* L. Millsp.) is primarily grown for its dhal (processed pulse) under diverse cropping systems including inter or mixed cropping. Pigeonpea is commonly known as redgram, tur and arhar is the fifth prominent legume crop in the world and important crop amongst pulses which ranks second after chickpea in India in terms of area and production. In India, pigeonpea is cultivated on an area of 4.78 million hectares with production of 4.25 million tones and productivity 889 kg per hectares.

The demand for pulses is increasing due to increasing population, to meet the growing demand, pigeonpea productivity has to be invariably increased through improved crop production technologies. Improper irrigation and nutrient management are the main reason for low productivity of pigeonpea. Increasing demand for irrigation water coupled with depleting ground water sources calls for efficient use of water. Therefore, there is need for efficient irrigation methods to these crops. The present scenario of flood irrigation should be replaced by more efficient controlled irrigation systems. Therefore use of modern irrigation systems like drip provides better crop growth and greater yields, due to efficient use of water and nutrients. Drip irrigation is slow and precise application of water and here the water is applied in the form of drops directly at the root zone at shorter intervals and thereby it saves water due to reduction in conveyance, percolation, evaporation losses besides improving field application and distribution irrigation efficiencies and ultimately resulting in higher water use efficiency

Pigeonpea can be intercropped with crops such as greengram, blackgram and soybean without significantly reducing the yield of the main crop. Pigeonpea is a late maturing, tall growing and wide spaced crop with deep root system which makes it suitable for intercropping system. Besides, the growth of pigeonpea is very slow in the early stages, during that time, the more

rapidly growing short duration and short statured crops like greengram, blackgram, soybean and also taller crops like pearlmillet and sesamum can be conveniently intercropped to utilize the natural resources most efficiently in the early stages of pigeonpea.

Material and Methods

A field experiment was conducted during the *kharif* 2018-19 at Zonal Agriculture Research Station, Kalaburgi, is situated at North Eastern Dry Zone of Karnataka at a latitude of 17º 34' North, longitude of 76^0 79' East and an altitude of 478 meters above mean sea level (MSL). The experiment was laid out in split plot design with three main factors of irrigation levels I_1: 50% CPE, I_2: 75% CPE and I_3: 100% CPE and four sub factors of cropping systems C_1: Sole pigeon pea, C_2: Pigeonpea + Greengram, C_3: Pigeonpea + Blackgram and C_4: Pigeonpea + Soybean, replicated thrice and Rainfed pigeonpea outside the control. Recommended dose of fertilizer for pigeonpea (25:50:0 kg N: P_2O_5: K_2O) were applied at the time of sowing. Nitrogen, phosphorous and potassium were applied in the form of diammonium phosphate (DAP) and Farm yard manure (FYM) @ 6 t ha^{-1} was incorporated into soil two weeks before sowing. Later on water soluble fertilizers were applied through drip irrigation *viz.*, 4 kg of 19:19:19 (N: P: K) and 8.5 kg of MAP (12:61:0) throughout the growing period of crop. The sowing was done on 13th june, 2018. The total rainfall received during the cropping season 549.80 mm.

The soil of the experimental site was black clay, slightly alkaline (8.20) with an electrical conductivity of 0.23 dS m^{-1}. The soil organic carbon content was low (0.52%). The soil was low in available nitrogen (235 kg ha^{-1}), medium in available phosphorus (32 kg ha^{-1}) and high in available potassium (460 kg ha^{-1}), respectively. Soil application of fertilizers applied at 30 DAS and foliar application of fertilizers at 50% flowering stage.

Results and Discussion

The growth attributes of pigeonpea as influenced by irrigation levels and cropping systems under drip irrigation. The data in table 1 showed that growth parameters *viz.*, plant height, number of primary branches per plant, number of secondary branches per plant, leaf area, leaf area index (LAI) and total dry matter production (TDMP) were recorded significantly highest by the irrigation scheduling at 75% CPE which was on par with the 100% CPE. Higher plant height (176.42 cm) might be due to adequate and timely supply of irrigation water at 75% CPE which provided better nourishment and enhanced the metabolic process in the plant and promoted the cell division and cell expansion and thereby stem elongation which virtually increased the plant growth in terms of plant height. These results were in conformity with the findings of Bibe *et al.* (2017) [3] and Mahalakshmi *et al.* (2011) [12]. Higher number of primary branches (15.04) and secondary branches per plant (16.23) might be due to availability of optimum moisture contributed to effective absorption and utilization of nutrients and better proliferation of roots resulting in better primary and secondary branches per plant. The results are in accordance with those of Sodavadiya *et al.* (2017) [24], Kher Udaysingh, (2016) [10] and Chaudhary *et al.* (2015) [4]. Higher leaf area (20.84 dm^2 plant^{-1}) and LAI (0.58) this is because of the accelerated vegetative growth resulted in an extensive photosynthetic apparatus and relative increase was recorded in leaf area and LAI. Similar results were found by Deewan *et al.* (2017) [5] Ranjitha *et al.* (2018) [19] and Hokam *et al.* (2011) [7]. Higher the total dry matter production (306.82 g plant^{-1}) this might be due to increased plant height and leaf area resulted in higher dry matter accumulation which was due to the maintenance of favourable soil water balance under 75% CPE throughout the crop life. This is in conformity with the result of Sampathkumar *et al.* (2006) [21], Shedeed *et al.* (2009) [22] and Shivkumar *et al.* (2011) [23].

The data in the table 1 showed that higher plant height (183.37 cm), number of primary branches per plant (9.84), number of secondary branches per plant (19.50), leaf area (25.55 dm^2 plant^{-1}), leaf area index (LAI) (0.71) and total dry matter production (TDMP) (340.98 g plant^{-1}) were recorded highest in sole pigeonpea cropping system compared to intercropping with greengram, blackgram and soybean. This might be due to the reason that there is no competition for the resources in sole pigeonpea thereby better availability of nutrients, light, water and spacing. Similar results were also reported by Rekha and Dhurva (2009) [2], Rani and Reddy (2010) [18] and Nagar *et al.* (2015) [15] and lower growth parameters in intercropping system due to increased competition for growth resources, specially the water, nutrients, light and CO_2 or space, this restricts the development of crop. This finding was in conformity with the result of Pujari and Sheelvantar (2002) [17] and Thomas and Lal (2004) [25].

The interaction effect between scheduling of irrigation and cropping systems on plant height (187.13 cm), number of primary branches per plant (17.87), number of secondary branches per plant (21.00), leaf area (26.51 dm^2 plant^{-1}), leaf area index (LAI) (0.74) and total dry matter production (TDMP) (352.07 g plant^{-1}) of pigeonpea was recorded higher in 75% CPE with sole pigeonpea. This might be due to better proportion of air-soil-water which was maintained throughout the life period of crop and also the maintenance of continuously optimum soil water potential, thus minimizing wide fluctuations in soil water content during the irrigation cycle. Similar results were also found by Kalpana and Salvi (2008) [9] and Basu and Bandyopadhyay (2009) [2], Malik *et al.* (2013) [13] and Jadhav *et al.* (2018) [8].

The rainfed pigeonpea recorded lower plant height (150.13 cm), number of primary branches per plant (7.50), number of secondary branches per plant (5.64), leaf area (9.8 dm^2 plant^{-1}), leaf area index (LAI) (0.27) and total dry matter production (TDMP) (162.56 g plant^{-1}).

The yield attributes of pigeonpea as influenced by irrigation levels and cropping systems under drip irrigation. The data in table 2 showed that yield parameters *viz.*, number of pods per plant (234.03), pod weight per plant (177.25 g), seed yield per plant (89.71 g plant^{-1}), test weight (9.92 g), grain yield (2524 kg ha^{-1}), stalk yield (5725 kg ha^{-1}) and husk yield (2408 kg ha^{-1}) were recorded significantly highest by the irrigation scheduling at 75% CPE which was on par with the 100% CPE. This might be due to maintenance of optimum soil moisture condition which affected the root nodulation as well as availability of different nutrients, further adequate availability of moisture at all stages of crop growth and development leading to high water potential, stomatal conductance, higher photosynthesis, partitioning of photosynthates to sink consequently increasing pods per plant, pod weight, seed yield per plant. These results are also in agreement with the findings Kalpana and Salvi (2008) [9], Muniyappa *et al.* (2017) [14] in chickpea and Sodavadiya *et al.* (2017) [24] in Indian bean.

The data in the table 2 showed that higher number of pods per plant (241.76), pod weight per plant (191.24 g plant^{-1}), seed

yield per plant (94.79 g plant^{-1}), test weight (10.22 g), grain yield (2656 kg ha^{-1}), stalk yield (6431 kg ha^{-1}) and husk yield (2485 kg ha^{-1}) were recorded significantly highest in sole pigeonpea cropping system compared to intercropping with greengram, blackgram and soybean. This might be due to more competition between the pigeonpea and intercrops thereby availability of nutrients, water and spacing will be less and recorded lower yield attributes in pigeonpea as compared to sole pigeonpea. This might also have resulted from inter- and intra- specific competition for plant growth resources (Fhatuwani *et al.*, 2016) [6]. Similar results were found by Lingaraju, *et al.* (2008) [11] and Rekha and Dhurva (2009) [20].

The interaction effect between scheduling of irrigation and cropping systems on higher number of pods per plant (246.76), pod weight per plant (205.63 g plant^{-1}), seed yield per plant (98.90 g plant^{-1}), test weight (10.40 g), grain yield (2750 kg ha^{-1}), stalk yield (6742 kg ha^{-1}) and husk yield (2504 kg ha^{-1}) of pigeonpea was found significant. The increased yield attributes with increased depth and interval of drip irrigation was due to higher chlorophyll content with enhanced photosynthetic activity and higher uptake of nutrients and thereby increased plant dry matter production in the pod setting phase which improved the pod development and finally contributed for higher productivity. These observations were similar to the findings of Mahalakshmi *et al.* (2011) [12], Akbar *et al.* (2011) [1] and Muniyappa *et al.* (2017) [14].

The rainfed pigeonpea recorded significantly lower number of pods per plant (170.35), pod weight per plant (115.63 g plant^{-1}), seed yield per plant (73.25 g plant^{-1}), test weight (8.60 g), grain yield (1080 kg ha^{-1}), stalk yield (2650 kg ha^{-1}) and husk yield (1510 kg ha^{-1}).

Economics of pigeonpea as influenced by irrigation levels and cropping systems under drip irrigation. The data in table 3 showed that economics of pigeonpea *viz.*, lower cost of cultivation (52810 Rs. ha^{-1}) with higher gross returns (Rs. 226245 ha^{-1}), net returns (Rs. 173435 ha^{-1}) and B: C ratio (4.29) were recorded by the irrigation scheduling at 75% CPE which was on par with the 100% CPE. This might be due to higher the yield recorded in 75% CPE irrigation scheduling thereby profit will be more compare to other treatments. Similar results were reported by Pramod *et al.*, (2006) [16], Muniyappa *et al.* (2017) [14] in chickpea and Deewan *et al.* (2017) [5] in clusterbean.

The data in the table 3 showed that lower cost of cultivation (38560 Rs. ha^{-1}) in sole pigeonpea but in Pigeonpea intercropped with greengram in 1:3 row proportions recorded significantly higher gross returns (Rs.252400 ha^{-1}), net returns (Rs. 196590 ha^{-1}) and BC ratio (4.52) when compared to sole pigeonpea, intercropped with blackgram and soybean. This might be due to higher the yield of pigeonpea and greengram coupled with higher market prices of both pigeonpea and intercrops thereby increase the profit.

The interaction effect between scheduling of irrigation and cropping systems on gross returns (Rs. 2,67,960 ha^{-1}), net returns (Rs. 2,12,150 ha^{-1}) and BC ratio (4.80) of pigeonpea significantly higher were recorded by scheduling of irrigation at 75% CPE with pigeonpea + greengram (1:3) intercropping system. This might be due to higher yield were recorded in this treatment compare to other treatments.

The rainfed pigeonpea recorded significantly lower gross returns (Rs. 66,880 ha^{-1}), net returns (Rs. 36,518 ha^{-1}) and BC ratio (2.20).

Table 1: Growth attributes of pigeonpea as influenced by irrigation levels and cropping systems under drip irrigation

Treatments	Plant height (cm)	No. of primary branches per plant	No. of secondary branches per plant	Leaf area (dm^2/plant)	Leaf area index	TDM (g/plant)
Main plots: Irrigation levels (I)						
50% CPE (I_1)	164.28	10.28	10.43	14.44	0.40	244.48
75% CPE (I_2)	176.42	15.04	16.23	20.84	0.58	306.82
100% CPE (I_3)	172.81	12.22	12.33	17.78	0.49	275.10
S.Em±	2.12	0.23	0.45	0.45	0.013	7.81
C.D. at 5%	8.32	0.92	1.76	1.77	0.049	30.65
Sub plot: Cropping systems (C)						
Sole pigeonpea (C_1)	183.37	17.29	19.50	25.55	0.71	340.98
Pigeonpea + Greengram (C_2)	164.41	9.84	8.97	13.79	0.38	231.45
Pigeonpea + Blackgram (C_3)	167.17	10.51	10.98	14.25	0.40	254.83
Pigeonpea + Soybean (C_4)	169.73	12.41	12.56	17.16	0.48	274.61
S.Em±	5.56	0.37	0.68	0.62	0.017	14.64
C.D. at 5%	16.52	1.10	3.30	1.84	0.051	43.48
Interaction effects (I x C)						
50% CPE x Sole pigeonpea (I_1 x C_1)	178.17	16.93	18.73	24.83	0.69	332.83
50% CPE x Pigeonpea + Greengram (I_1 x C_2)	154.23	7.80	5.93	10.59	0.29	169.82
50% CPE x Pigeonpea + Blackgram (I_1 x C_3)	160.57	8.13	8.40	11.05	0.31	230.04
50% CPE x Pigeonpea + Soybean (I_1 x C_4)	164.13	8.27	8.67	11.29	0.31	245.24
75% CPE x Sole pigeonpea (I_2 x C_1)	187.13	17.87	21.00	26.51	0.74	352.07
75% CPE x Pigeonpea + Greengram (I_2 x C_2)	171.50	12.40	11.00	15.88	0.44	277.17
75% CPE x Pigeonpea + Blackgram (I_2 x C_3)	172.60	13.07	14.33	16.36	0.45	278.82
75% CPE x Pigeonpea + Soybean (I_2 x C_4)	174.44	16.82	18.60	24.62	0.68	319.23
100% CPE x Sole pigeonpea (I_3 x C_1)	184.80	17.07	18.77	25.30	0.70	338.06
100% CPE x Pigeonpea + Greengram (I_3 xC_2)	167.50	9.33	9.97	14.91	0.41	247.35
100% CPE x Pigeonpea + Blackgram (I_3 x C_3)	168.33	10.33	10.20	15.34	0.43	255.65
100% CPE x Pigeonpea + Soybean (I_3 x C_4)	170.60	12.13	10.40	15.57	0.43	259.35
S.Em±	8.60	0.60	1.11	1.03	0.029	23.30
C.D. at 5%	25.56	1.79	2.34	3.07	0.085	69.23
Rainfed pigeonpea	150.13	7.50	5.64	9.80	0.27	162.56

S.Em±	8.53	0.59	1.08	1.01	0.03	23.20
C.D. at 5%	24.90	1.72	2.35	2.96	0.08	67.71

Table 2: Yield and yield attributes of pigeonpea as influenced by irrigation levels and cropping systems under drip irrigation

Treatments	Number of pods plant^{-1}	Pod weight Plant^{-1} (g)	Seed yield Plant^{-1} (g)	Test weight (g)	Grain yield (kg ha^{-1})	Stalk yield (kg ha^{-1})	Husk yield (kg ha^{-1})
Main plots: Irrigation levels (I)							
50% CPE (I_1)	203.80	141.89	80.63	9.06	2276	4483	2067
75% CPE (I_2)	234.03	177.25	89.71	9.92	2524	5725	2408
100% CPE (I_3)	226.74	159.68	86.85	9.49	2462	5083	2230
S.Em±	6.47	3.79	1.77	0.18	37	168	54
C.D. at 5%	25.42	14.87	6.95	0.69	146	660	210
Sub plot: Cropping systems (C)							
Sole pigeonpea (C_1)	241.76	191.24	94.79	10.22	2656	6431	2485
Pigeonpea + Greengram (C_2)	207.26	141.78	81.09	9.12	2304	4364	2045
Pigeonpea + Blackgram (C_3)	213.74	149.45	83.24	9.20	2358	4575	2155
Pigeonpea + Soybean (C_4)	222.78	155.95	83.81	9.41	2366	5019	2255
S.Em±	6.21	4.05	1.98	0.31	58	200	80
C.D. at 5%	18.45	12.02	5.90	0.91	170	590	240
Interaction effects (I x C)							
50% CPE x Sole pigeonpea (I_1 x C_1)	237.25	182.50	88.37	10.07	2501	6208	2469
50% CPE x Pigeonpea + Greengram (I_1 x C_2)	180.75	120.50	76.31	8.63	2171	3742	1726
50% CPE x Pigeonpea + Blackgram (I_1 x C_3)	188.40	125.60	78.68	8.70	2216	3908	1992
50% CPE x Pigeonpea + Soybean (I_1 x C_4)	207.11	138.96	79.17	8.83	2218	4075	2082
75% CPE x Sole pigeonpea (I_2 x C_1)	246.76	205.63	98.80	10.40	2750	6742	2504
75% CPE x Pigeonpea + Greengram (I_2 x C_2)	227.29	162.35	84.59	9.67	2399	4908	2300
75% CPE x Pigeonpea + Blackgram (I_2 x C_3)	229.20	168.53	87.30	9.77	2449	5075	2360
75% CPE x Pigeonpea + Soybean (I_2 x C_4)	232.88	172.50	88.16	9.83	2498	6175	2466
100% CPE x Sole pigeonpea (I_3 x C_1)	241.28	185.60	97.21	10.20	2718	6342	2483
100% CPE x Pigeonpea + Greengram (I_3 xC_2)	213.75	142.50	82.37	9.07	2343	4442	2109
100% CPE x Pigeonpea + Blackgram (I_3 x C_3)	223.60	154.21	83.73	9.13	2408	4742	2112
100% CPE x Pigeonpea + Soybean (I_3 x C_4)	228.34	156.40	84.10	9.57	2381	4808	2217
S.Em±	10.76	7.15	3.46	0.49	95	345	130
C.D. at 5%	31.96	21.26	10.29	1.46	280	1025	390
Rainfed pigeonpea	170.35	115.63	73.25	8.60	1080	2650	1510
S.Em±	10.78	7.24	3.58	0.49	96	366	131
C.D. at 5%	31.46	21.12	10.45	1.44	280	1068	380

Table 3: Economic of pigeonpea as influenced by irrigation levels and cropping systems under drip irrigation

Treatments	Gross returns (Rs. ha^{-1})	Cost of cultivation (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	BC Ratio
Main plots: Irrigation levels (I)				
50% CPE (I_1)	196020	52310	143710	3.77
75% CPE (I_2)	226245	52810	173435	**4.29**
100% CPE (I_3)	218010	53310	164700	4.10
S.Em±	4630	-	4630	0.08
C.D. at 5%	18210	-	18210	0.30
Sub plot: Cropping systems (C)				
Sole pigeonpea (C_1)	159380	38560	120820	4.13
Pigeonpea + Greengram (C_2)	252400	55810	196590	**4.52**
Pigeonpea + Blackgram (C_3)	230700	58060	172640	3.97
Pigeonpea + Soybean (C_4)	211220	58810	152410	3.59
S.Em±	5850	-	5850	0.12
C.D. at 5%	17390	-	17390	0.40
Interaction effects (I x C)				
50% CPE x Sole pigeonpea (I_1 x C_1)	150060	38060	112000	3.94
50% CPE x Pigeonpea + Greengram (I_1 x C_2)	230280	55310	174970	4.16
50% CPE x Pigeonpea + Blackgram (I_1 x C_3)	208260	57560	150700	3.62
50% CPE x Pigeonpea + Soybean (I_1 x C_4)	195480	58310	137170	3.35
75% CPE x Sole pigeonpea (I_2 x C_1)	165000	38560	126440	4.28
75% CPE x Pigeonpea + Greengram (I_2 x C_2)	267960	55810	212150	4.80
75% CPE x Pigeonpea + Blackgram (I_2 x C_3)	246720	58060	188660	4.25
75% CPE x Pigeonpea + Soybean (I_2 x C_4)	225300	58810	166490	3.83
100% CPE x Sole pigeonpea (I_3 x C_1)	163080	39060	124020	4.18
100% CPE x Pigeonpea + Greengram (I_3 xC_2)	258960	56310	202650	4.60
100% CPE x Pigeonpea + Blackgram (I_3 x C_3)	237120	58560	178560	4.05
100% CPE x Pigeonpea + Soybean (I_3 x C_4)	212880	59310	153570	3.59

S.Em±	9930	-	9930	0.22
C.D. at 5%	29500	-	29500	0.65
Rainfed pigeonpea	66880	30362	36518	2.20
S.Em±	7886	-	7844	0.16
C.D. at 5%	23018	-	22896	0.47

Conclusion

From the above study it can be inferred that, scheduling of irrigation at 75% CPE with sole pigeonpea recorded higher growth and yield attributes but 75% CPE with pigeonpea + greengram (1:3) intercropping system was found to be more profitable system as it was recorded significantly higher net returns and benefit cost ratio when compared to other irrigation scheduling and cropping systems.

Reference

1. Akbar N, Iqbal M, Ehsanullah Iqbal A, Khan HZ. Agro-qualitative response of two cultivars of chickpea (*Cicer arietinum*) to different sowing techniques under irrigated conditions of Faisalabad. Crops Environ. 2011; 2(1):19-23.
2. Basu TK, Bandyopadhyay SR. Productivity of *rabi* pigeonpea (*Cajanus cajan* L. Milsp.) as influenced by scheduling of irrigation. J Crop Weed. 2009; 5(2):90-91.
3. Bibe SM, Jadhav KT, Chavan AS. Response of irrigation and fertigation management on growth and yield of maize (*Zea mays.)*. Int. J Curr. Microbiol. App. Sci. 2017; 6(11):4054-4060.
4. Chaudhary AN, Vihol KJ, Mor VB. Water use efficiency, yield, available nutrient and economics of greengram (*Vigna radiata* (L.) Wilzek) as influenced by plant density and irrigation management. Trends Biosci. 2015; 7(22):3761-3764.
5. Deewan P, Regar KL, Jajoriya M, Meena M, Verma R. Influence of irrigation scheduling (IW/CPE ratios) and plant growth regulators on quality, yield and economics of summer clusterbean (*Cyamopsis tetragonoloba* L.) under middle Gujarat conditions. Int. J Chem. Stud. 2017; 5(5):467-471.
6. Fhatuwani HN, Irvine KM, Funso RK. Growth and yield responses of pigeonpea (*Cajanus cajan* L.) to variable phosphorus application rates when intercropped with maize under dryland conditions. J Agric. Crop. 2016; 2(12):121-130.
7. Hokam EM, El-Hendawy SE, Schmidhalter U. Drip irrigation frequency : the effects and their interaction with nitrogen fertilization on maize (*Zea mays.)* growth and nitrogen use efficiency under arid conditions. J Agron. Crop Sci. 2011; 197:186- 201.
8. Jadhav KT, Chavan AS, Raskar SK, Lahase RU. Influence of spacing and drip irrigation on yield attributes, productivity and economics of pigeonpea (*Cajanus cajan* L.). Int. J Curr. Microbiol. App. Sci. 2018; 7(2):3498-3506.
9. Kalpana R, Salvi RV. Effect of irrigation layouts on growth and yield of legumes. Agric. Rev. 2008; 29(2):139-144.
10. Kher Udaysing A. Response of summer greengram (*Vigna radiata* (L.) Wilzek) to irrigation scheduling based on IW/CPE ratios and spacing. M.Sc. (Agri.) Thesis, Junagadh Agric. Univ., Junagadh, 2016.
11. Lingaraju BS, Marer SB, Chandrashekar SS. Studies on intercropping of maize (*Zea mays.)* and pigeonpea (*Cajanus cajan* L.) under rainfed conditions in northern transitional zone of Karnataka. J Agric. Sci. 2008; 21:1-3.
12. Mahalakshmi K, Avil KK, Reddy MD, Uma DM. Response of *rabi* pigeonpea [*Cajanus cajan* (L.)] to different levels of drip irrigation. J Res. ANGRAU. 2011; 39(4):101-103.
13. Malik JK, Singh R, Thenua OVS, Kumar A. Response of pigeonpea (*Cajanus cajan*) + mungbean (*Phaseolus radiatus*) intercropping system to phosphorus and biofertilizers. Legume Res. Int. J. 2013; 36(4):323.
14. Muniyappa, Mudalagiriyappa, Ramachandrappa BK, Nagaraju, Sathish A. Studies on the influence of depth and interval of drip irrigation on yield, water use efficiency and economics of chickpea (*Cicer arietinum* L.). Int. J Pure App. Biosci., 2017; 5(1):771-776.
15. Nagar RK, Goud VV, Kumar R, Kumar R. Effect of incorporation of FYM, pigeonpea stalk, phosphocompost on growth, yield and nutrient uptake in pigeonpea (*Cajanus cajan* L.) based intercropping system. The Bioscan: J Life Sci. 2015; 10(3):339-343.
16. Pramod MC, Arun BK, Pankaj UR, Sanjay SC. Effect of intercropping of pigeonpea, sorghum and cotton on productivity and yield advantages of soybean (*Glycine max* L.) under rainfed condition. Int. J Agric. Sci. 2006; 2(2):478-479.
17. Pujari BT, Sheelvantar MN. Dry matter accumulation in plant parts of greengram (*Vigna radiata*) as influenced by cropping system, row proportion and greengram population levels. Indian J Agric. Res. 2002; 36:156-161.
18. Rani BP, Reddy DR. Performance of pigeonpea when inter cropped with soybean (*Glycine max*) under different dates in the rainfed *Vertisols* of Krishna Godavari zone of Andhra Pradesh. Indian J Agric. Res. 2010; 44(3):225 - 228.
19. Ranjitha PS, Ramulu V, Jayasree G, Reddy SN. Growth, Yield and Water Use Efficiency of Groundnut *(Arachis hypogaea)* under Drip and Surface Furrow Irrigation. Int. J. Curr. Microbiol. App. Sci. 2018; 7(9):1371-1376.
20. Rekha MS, Dhurua S. Productivity of pigeonpea (*Cajanus cajan* L.) + soybean *(Glycine max)* intercropping system as influenced by planting patterns and duration of pigeonpea varieties under rainfed conditions. Legume Res. 2009; 32(1):51-54.
21. Sampathkumar TS, Krishnasamy S, Ramesh K, Shanmugasundaram. Effect of drip and surface irrigation methods with rice straw mulch on productivity and water use efficiency of summer cotton (*Gossypium hirsutum*). Season Res. 2006; 32(2):141-144.
22. Shedeed IS, Zaghloul SM, Yassen AA. Effect of method and rate of fertilizer application under drip irrigation on yield and nutrient uptake by tomato (*Lycopersicon esculentum* Mill.). Ozean J Applied Sci. 2009; 2(2):139-147.
23. Shivakumar HK, Ramachandrapp BK, Nanjappa S, Mudalagiriyappa HV. Effect of phenophase based irrigation schedules on growth, yield and quality of baby corn (*Zea mays* L.). Agric. Sci. 2011; 2(3):267-272.
24. Sodavadiya HB, Naik VR, Chaudhari SD. Effect of land configuration, irrigation and INM on growth, yield and water use efficiency of Indian Bean *(Lablab purpureus)*

(var. GNIB-21). Int. J Curr. Microbiol. App. Sci. 2017; 6(7):2624-2630.
25. Thomas A, Lal RB. Performance of Blackgram (*Vigna mungo* L.) under Integrated Nutrient Management (INM) in a legume based cropping system for the inceptisols of NEPZ. Indian J Dryland Agric. Res. Dev. 2004; 1(19):81-87.