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Evaluation of Spacing and Nipping Time under different Sowing Time in System of Chickpea Intensification for Climate Change Adaptation

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A B S T R A C T

A field experiment was laid out to evaluate effect of spacing and nipping time in different sowing time of chickpea at Agriculture Instructional cum Research Farm, IGKV, Raipur, Chhattisgarh during two consecutive winter seasons of 2016-17 and 2017-18 with four sowing time (First week of November, Third week of November, First week of December and Third week of December), three spacing (30x20, 40x20 and 50x20 cm) and three nipping time (No nipping, Nipping at 30 days, Nipping at 40 days). Nodulation and yield attributes were observed higher in November sowing with 50x20cm and 40x20 cm spacing. Spacing of 50x20 cm recorded higher seed yield (11.0 to 11.5%) and net return (24.2 to 24.7%) in first and third week of November sowing, moreover, spacing of 30x20 cm recorded higher seed yield (11.0 to 12.6%) and net return (21.9 to 23.1%) in third week of December sowing. Nipping at 30-40 DAS recorded increase of 4.8 to 7.5% in seed yield and 3.8 to 8.3% in net return in November sowing, however, it caused decrease of 9.3 to 12.2 % in seed yield and 30.7 to 37.5 % in net return in third week of December sowing.

Introduction

Pulses are the most important source of protein in vegetarian diets. Looking into dietary essentiality of pulses, United nations declared 2016 as the International Year of Pulses. Chickpea is an important winter season pulse crop in India with 8.40 million hectare area and total production of 7.06 million metric tonnes during 2015-16 (Annual report, 2016-17). Chickpea is the most important crop grown during winter season in Chhattisgarh plain agro-climatic zone of India. It occupies 0.37 million ha with productivity of 1100 kg/ha (Krishi Darshika, 2018). The low productivity of chickpea is mainly due to

change in climatic condition, enhanced pest attack and improper agro-techniques particularly under climate change scenario.

As per projection, India will begin to experience more seasonal variation in temperature with more warming in the winter season (Kumar and Gautam, 2014) and an increase of average temperature of 1^0C can decrease yield of major food crops by 3.1-7.4% (Zhao *et al.,* 2017). Due to change in climatic condition winter season, chickpea is not performing well under the current recommended package of practices and shorter winter period exposes the chickpea crop often to hot condition during pod formation and grain filling stage. Hatfield and Prueger (2015) reported that warm temperature increased the rate of senescence during grain filling stage and reduced final grain yield.

There are several reports suggesting adaptation strategies to reduce ill effect of climate change such as, adjustment of planting dates, variety, crop relocation, improved land management, etc.

System of chickpea intensification has been reported to produce higher seed yield of chickpea compared to conventional sowing method recently (Sonboir and Tripathi, 2018, 2019) which is attributed with wider spacing and nipping practice. However, spacing and nipping practice can affect the chickpea crop in differently in varying sowing time as in changed climatic condition, the late sown crops has lesser biomass due to short winter period and exposure to heat during terminal stages. Therefore, a study was undertaken to know the effect of spacing and nipping time under varying sowing time in nodulation, yield and economic feasibility of chickpea under irrigated condition and to develop climate change adaptation strategies for chickpea.

Materials and Methods

A field experiment was conducted at Agriculture Instructional cum Research farm, IGK Raipur during two consecutive winter seasons of 2016-17 and 2017-18. The soil was clay in texture (*Vertisols*), neutral in soil reaction (pH 7.1), normal in electrical conductivity (0.16 dS/m), low in available nitrogen (219.7 kg/ha), medium in available phosphorus (13.9 kg/ha) and high in potassium (365.1 kg/ha). The experiment was laid out in split-split plot design with three replications. Main plot treatment consisted of four sowing time, *viz*. First week of November, third week of November, first week of December and third week of December, sub-plot treatments had three levels of spacing, *viz*. 30x20 cm, 40x20 cm and 50x20 cm and sub-sub plot treatments had three nipping time *viz*. No nipping, nipping at 30 days and nipping at 40 days. The test variety was JG 130. The chickpea crop was fertilized with 20:50:30 kg NP_2O_5:K_2O/ha at basal. The irrigation was given thrice, first just after sowing to ensure germination with 5cm irrigation water and subsequent irrigation at 30 days and 50 days after sowing with 4cm of irrigation water. The field were kept weed free through mechanical weeding at 20 and 40 days. The crop received 0.8 and 16.4 mm of rains during 2016-17 and 2017-18, respectively. During 2016-17, the winter season maximum temperature rising from 1st week of February. Moreover, during 2017-18, maximum temperature started rising from 3rd week of February. The number and dry weight of nodules were recorded at pre-flowering stage by destructive plant sampling with proper care. The seed and straw yield were recorded from net plot area after removing the border area. The gross return, cost of cultivation and net return were calculated from market price of the different inputs and outputs. B:C ratio was calculated by dividing gross return to cost of cultivation. All the data

were subjected to analysis of variance as suggested by Gomez and Gomez (1983) for proper inference of results.

Results and Discussion

Number and dry weight of nodules/plant

Number and dry weight of nodules were significantly influenced by sowing time, spacing and nipping time (Table 1). Third week of November sowing exhibited maximum number of nodules per plant and nodule dry weight, which was however statistically similar to first week of November sowing. December sown chickpea crop showed decrease in nodules and nodule dry weight/plant. The lowest number and dry weight of nodules were recorded in third week of December sowing with significant difference to others. Similar report is also observed by Thalji and Shalaldeh (2006). Regarding spacing, 50x20 cm recorded more number and dry weight of nodules per plant which was however statistically at par with spacing of 40x20 cm. Closer spacing of 30x20 cm exhibited the lowest number and dry weight of nodules. Nipping time did not exert any significant difference in number and dry weight of nodules per plant.

Yield attributes

Number of pods/plant, number of seeds/pod and seed index were significantly influenced by sowing time, spacing and nipping time. Among all these yield attributes, only number of pods/plant differed significantly due to differences in sowing time.

Third week of November sowing exhibited significantly higher number of pods/plant, number of seeds/pod and seed index, statistically at par with first week of November sowing (Table 2). December sown chickpea crop showed decrease in number of pods/plant, seeds/pod and seed index. The lowest number of pods/plant, number of seeds/pod and seed index were recorded in third week of December sowing with significant difference to others. Spacing of 50x20 cm spacing produced more number of pods/plant in all the sowing time with significant difference; however, it was par with 40x20 cm spacing in first week of December sowing. Wider spacing of 50x20 cm spacing produced 29.8 to 31.7% more number of pods /plant as compared to closer spacing of 30x20 cm in November sowing of chickpea. Increase in number of pods/plant with increase in row spacing is also reported by Sonboir *et al.*, (2017). Third week of December sowing did not exert any significant difference in number of pods due to spacing (Table 3).

Nipping exerted significant contribution only in number of pods/plant in first and third week of November sowing and the maximum number of pods/plant was recorded with nipping at 40 days however it was at with nipping at 30 days.

Nipping recorded 15.3 to 21.2% increase in number of pods/plant in November sowing of chickpea. December first week sowing did not exhibited any significant difference in number of pods/plant while third week of December sowing recorded decrease in number of pods/plant due to nipping and the decrease was to the tune of 7.0 to 8.2%. (Table 4)

Seed yield, straw yield and harvest index

Seed yield, straw yield and harvest index were significantly influenced by sowing time, spacing and nipping time moreover, interaction effect of sowing time with spacing and nipping time were found significant. The variation in yield level was also observed in both years of study and the lower yield obtained during 2016-17 may be due to shorter winter period.

First week of November sowing exhibited significantly higher seed yield, straw yield and harvest index, statistically at par with third week of November sowing (Table 5). December sown chickpea crop showed decrease in seed yield, straw yield and harvest index. The lowest seed yield, straw yield and harvest index were recorded in third week of December sowing with significant difference to others. The lower yield in late sown crop may be due heat stress during reproductive development (Devasirvatham *et al.,* 2012). The maximum seed and straw was recorded with 50x20 cm spacing in first and third week of November sowing however it was statistically par with 40x20 cm spacing in third week of November sowing. The average increase in seed yield was recorded 11.0 to 11.5 % under 50x20 cm spacing compared to closer spacing of 30x20 cm in November sowing time. Higher yield under wider spacing in early sown crop may be due to better expression of growth parameters and availability of sufficient time to mature crop within desired temperature range. Similar result is also reported by Mondal (2000). Spacing of 40x20 cm recorded maximum seed and straw yield in first week of December sowing time which was statistically at par with 30x20 cm spacing. In third week of December sowing time, closer spacing of 30x20 cm recorded maximum seed and straw yield with significant difference and the decreased the average seed yield to the tune of 11.0 to 12.6% due to increase in spacing (Table 6).

Nipping time exhibited significant effect on seed and straw yield in different sowing time (Table 7). The maximum seed yield was recorded in nipping at 40 days which was however statistically similar to nipping at 30 days in first and third week of November sowing time. Yield enhancement with nipping of terminal buds in chickpea is also reported by Baloch and Zubair (2010). The average increase in seed yield was 4.8 to 7.5% over no nipping in November sowing of chickpea. Nipping did not exhibit seed yield enhancement in December first week sowing time, however, higher straw yield was recorded under nipping at 30 days. No nipping recorded maximum seed and straw yield in third week of December sowing. Nipping caused 9.3 to 12.2 % and decrease in seed yield over no nipping. The reduction in seed yield of chickpea with progressive delay in sowing beyond 10th December is also reported by Shrivastava *et al.,* (1990).

Gross return, net return and B:C ratio

Gross return, net return and B:C ratio were significantly influenced by sowing time, spacing and nipping time moreover, interaction effect of sowing time with spacing and nipping time were found significant.

First week of November sowing recorded significantly higher gross return, net return and B:C ratio followed by third week of November sowing (Table 8).

December sown chickpea crop showed more decrease in gross return, net return and B:C ratio. The lowest gross return, net return and B:C ratio were recorded in third week of December sowing with significant difference.

50x20 cm spacing recorded higher gross return, net return and B:C ratio in first and third week of November sowing. The average increase in net return was recorded 24.2 to 24.7 % under 50x20 cm spacing compared to closer spacing of 30x20 cm in November sowing time. Spacing of 40x20 cm recorded maximum gross, net return and BC ratio in first week of December sowing time which was statistically at par with 30x20 cm spacing. Closer spacing of 30x20 cm recorded maximum gross return, net return and B:C ratio in third week of December sowing time with significant difference.

The average decrease in net return was to the tune of 21.9 to 23.1% due to increase in spacing in third week of December sowing (Table 9).

Table.1 Number and dry weight of nodules at pre-flowering stage of chickpea as influenced by sowing time, spacing and nipping under SCI.

Treatments	Number of nodules/plant			Dry weight of nodules/plant, g		
	2016	2017	Mean	2016	2017	Mean
Sowing time						
Nov. 1st week	34.3	57.4	45.9	0.57	0.78	0.68
Nov. 3rd week	45.9	48.3	47.1	0.72	0.69	0.71
Dec. 1st week	29.0	32.5	30.8	0.47	0.53	0.50
Dec.3rd week	21.9	24.1	23.0	0.38	0.42	0.40
CD (p=0.05)	1.46	1.8	1.7	0.06	0.08	0.07
Spacing						
30x20 cm	31.8	39.5	35.7	0.51	0.75	0.63
40x20 cm	32.6	40.7	36.7	0.53	0.79	0.66
50x20 cm	34.0	41.6	37.8	0.56	0.82	0.69
CD (p=0.05)	1.4	1.6	1.5	0.02	0.03	0.03
Nipping time						
No nipping	32.0	40.3	36.2	0.52	0.75	0.64
Nipping at 30 DAS	32.8	40.6	36.7	0.53	0.77	0.65
Nipping at 40 DAS	33.5	40.8	37.2	0.55	0.78	0.67
CD (p=0.05)	1.2	NS	NS	0.02	NS	NS

Table.2 Yield attributes of chickpea as influenced by sowing time, spacing and nipping under SCI.

Treatments	Number of pods/plant			Number of seeds/pod			Seed index, g		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
Sowing time									
Nov. 1st week	76.3	91.7	84.0	1.73	1.76	1.75	22.35	28.45	25.40
Nov. 3rd week	83.5	85.4	84.4	1.75	1.73	1.74	24.01	27.64	25.83
Dec. 1st week	57.0	60.2	58.6	1.62	1.64	1.63	20.25	26.52	23.39
Dec.3rd week	44.5	47.9	46.2	1.48	1.52	1.50	18.47	24.53	21.50
CD (p=0.05)	2.4	4.6	3.5	0.04	0.06	0.05	0.63	0.84	0.74
Spacing									
30x20 cm	56.7	66.3	61.5	1.62	1.64	0.05	20.96	26.54	23.75
40x20 cm	65.1	72.1	68.6	1.65	1.66	1.63	21.40	26.76	24.08
50x20 cm	74.1	75.4	74.8	1.66	1.67	1.66	21.45	27.06	24.26
CD (p=0.05)	2.0	1.8	1.9	NS	NS	NS	0.32	0.42	0.37
Nipping time									
No nipping	62.5	68.2	65.4	1.62	1.65	1.64	20.98	26.75	23.87
Nipping at 30 DAS	66.7	72.5	69.6	1.64	1.66	1.65	21.32	26.87	24.10
Nipping at 40 DAS	66.8	73.3	70.0	1.67	1.66	1.67	21.50	26.76	24.13
CD (p=0.05)	1.6	1.5	1.6	0.04	NS	NS	0.30	NS	NS

Table.3 Number of pods/plant of chickpea as influenced by interaction effect of sowing time and spacing under SCI.

Treatments	Number of pods/plant								
	30x20 cm			40x20cm			50x20 cm		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
Nov. 1st week	64.0	80.5	72.3	74.0	95.1	84.6	90.9	99.5	95.2
Nov. 3rd week	68.2	78.7	73.5	83.6	85.3	84.5	98.6	92.1	95.4
Dec. 1st week	52.68	58.3	55.5	58.0	59.9	59.0	60.4	62.3	61.4
Dec.3rd week	41.71	47.5	44.6	45.0	47.9	46.5	46.8	48.2	47.5
CD (p=0.05)	Spacing at same sowing time						4.1	5.4	4.8
	Sowing time at same spacing						4.1	5.1	4.6

Table.4 Number of pods/plant of chickpea as influenced by interaction effect of sowing time and nipping under SCI.

Treatments	Number of pods/plant								
	No nipping			Nipping at 30 DAS			Nipping at 40 DAS		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
Nov. 1st week	68.6	80.3	74.5	79.5	95.1	87.3	80.8	99.7	90.3
Nov. 3rd week	73.5	79.0	76.3	87.8	88.1	88.0	89.1	89.1	89.1
Dec. 1st week	60.5	63.4	62.0	56.1	59.8	58.0	54.5	57.4	56.0
Dec.3rd week	47.4	50.0	48.7	43.4	47.1	45.3	42.7	46.6	44.7
CD (p=0.05)	Nipping at same sowing time						3.2	4.8	4.0
	Sowing time at same nipping						3.5	4.3	3.9

Table.5 Seed yield of chickpea as influenced by sowing time, spacing and nipping under SCI.

Treatments	Seed yield, kg/ha			Straw yield, kg/ha			Harvest index		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
Sowing time									
Nov. 1st week	2226	2889	2558	3897	4285	4091	36.33	40.27	38.30
Nov. 3rd week	2349	2573	2461	4118	3810	3964	36.31	40.31	38.31
Dec. 1st week	1827	2099	1963	3460	3318	3389	34.56	38.76	36.66
Dec.3rd week	1411	1590	1501	2932	2871	2902	32.53	35.65	34.09
CD (p=0.05)	93	129	111	78	93	86	1.44	1.86	1.65
Spacing									
30x20 cm	1903	2276	2090	3605	3593	3599	34.43	38.78	36.61
40x20 cm	1978	2296	2137	3604	3599	3602	35.16	38.94	37.05
50x20 cm	1980	2292	2136	3596	3520	3558	35.20	39.43	37.32
CD (p=0.05)	51	NS	NS	NS	NS	NS	NS	NS	NS
Nipping time									
No nipping	1921	2271	2096	3539	3581	3560	35.03	38.81	36.92
Nipping at 30 DAS	1993	2293	2143	3651	3557	3604	35.06	39.20	37.13
Nipping at 40 DAS	1947	2299	2123	3614	3575	3595	34.71	39.15	36.93
CD (p=0.05)	30	NS	NS	52	58	55	NS	1.02	NS

Table.6 Seed and straw yield of chickpea as influenced by interaction effect of sowing time and spacing under SCI.

Treatments	30x20 cm			40x20cm			50x20 cm		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
Seed yield, kg/ha									
Nov. 1st week	2077	2787	2432	2260	2801	2531	2342	3079	2711
Nov. 3rd week	2159	2458	2309	2428	2595	2512	2460	2666	2563
Dec. 1st week	1834	2142	1988	1855	2258	2057	1794	1898	1846
Dec.3rd week	1541	1718	1630	1370	1529	1450	1324	1524	1424
CD (p=0.05)	Spacing at same sowing time						103	160	132
	Sowing time at same spacing						124	183	154
Straw yield, kg/ha									
Nov. 1st week	3723	4186	3955	3909	4325	4117	4060	4344	4202
Nov. 3rd week	3973	3739	3856	4129	3766	3948	4251	3925	4088
Dec. 1st week	3462	3359	3411	3550	3509	3530	3366	3084	3225
Dec. 3rd week	3262	3087	3175	2827	2797	2812	2706	2728	2717
CD (p=0.05)	Spacing at same sowing time						152	165	159
	Sowing time at same spacing						146	154	150

Table.7 Seed and straw yield of chickpea as influenced by interaction effect of sowing time and nipping under SCI.

Treatments	No nipping			Nipping at 30 DAS			Nipping at 40 DAS		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
Seed yield, kg/ha									
Nov. 1st week	2119	2793	2456	2262	2909	2586	2299	2964	2632
Nov. 3rd week	2251	2476	2364	2387	2569	2478	2410	2673	2542
Dec. 1st week	1812	2081	1947	1937	2148	2043	1732	2069	1901
Dec.3rd week	1501	1733	1617	1386	1546	1466	1347	1492	1420
CD (p=0.05)	Nipping at same sowing time						60	120	90
	Sowing time at same nipping						104	161	133
Straw yield, kg/ha									
Nov. 1st week	3742	4227	3985	3943	4278	4111	4007	4349	4178
Nov. 3rd week	3931	3769	3850	4190	3741	3966	4232	3920	4076
Dec. 1st week	3409	3302	3356	3570	3394	3482	3400	3257	3329
Dec.3rd week	3539	3024	3282	3400	2815	3108	2818	2773	2796
CD (p=0.05)	Nipping at same sowing time						104	134	119
	Sowing time at same nipping						115	119	117

Table.8 Economics of chickpea as influenced by sowing time, spacing and nipping under SCI

Treatment	Gross return, Rs/ha			Net return, Rs/ha			B:C ratio		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
Sowing time									
Nov. 1st week	89059	124913	106986	52023	80500	66262	2.41	2.82	2.62
Nov. 3rd week	93972	111249	102611	56935	66836	61886	2.54	2.51	2.53
Dec. 1st week	73094	90887	81991	36057	46474	41266	1.98	2.05	2.02
Dec.3rd week	56459	69028	62744	19422	24615	22019	1.53	1.56	1.55
CD (p=0.05)	3680	4765	4223	3680	4765	4223	0.10	0.13	0.12
Spacing									
30x20 cm	76107	98531	87319	37731	52532	45132	1.98	2.14	2.06
40x20 cm	79128	99368	89248	42137	55010	48574	2.14	2.24	2.19
50x20 cm	79203	99160	89182	43460	56278	49869	2.22	2.31	2.27
CD (p=0.05)	2058	NS	1045	2058	NS	1045	0.06	0.07	0.07
Nipping time									
No nipping	76834	98306	87570	41164	55766	48465	2.16	2.31	2.24
Nipping at 30 DAS	79717	99238	89478	41997	53888	47943	2.12	2.19	2.16
Nipping at 40 DAS	77888	99514	88701	40168	54165	47167	2.07	2.20	2.14
CD (p=0.05)	1193	1134	1164	1193	1134	1164	0.03	0.04	0.04

Table.9 Economics of chickpea as influenced by interaction effect of sowing time and spacing under SCI

Treatments	30x20 cm			40x20cm			50x20 cm		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
Gross return, kg/ha									
Nov. 1st week	83082	120527	101805	90406	121198	105802	93690	133014	113352
Nov. 3rd week	86377	106316	96347	97129	112158	104644	98411	115275	106843
Dec. 1st week	73349	92721	83035	74183	97733	85958	71749	82207	76978
Dec.3rd week	61622	74558	68090	54792	66383	60588	52963	66143	59553
CD (p=0.05)	Spacing at same sowing time						4115	5321	4718
	Sowing time at same spacing						4971	6124	5548
Net return, kg/ha									
Nov. 1st week	44705	74528	59617	53416	76840	65128	57947	90132	74040
Nov. 3rd week	48000	60317	54159	60138	67799	63969	62668	72393	67531
Dec. 1st week	34972	46722	40847	37193	53375	45284	36006	39325	37666
Dec.3rd week	23245	28560	25903	17801	22025	19913	17220	23261	20241
CD (p=0.05)	Spacing at same sowing time						4115	5321	4718
	Sowing time at same spacing						4971	6124	5548
B:C ratio									
Nov. 1st week	2.16	2.62	2.39	2.44	2.73	2.59	2.62	3.10	2.86
Nov. 3rd week	2.25	2.31	2.28	2.63	2.53	2.58	2.75	2.69	2.72
Dec. 1st week	1.91	2.02	1.97	2.01	2.20	2.11	2.01	1.92	1.97
Dec.3rd week	1.61	1.63	1.62	1.48	1.50	1.49	1.49	1.55	1.52
CD (p=0.05)	Spacing at same sowing time						0.11	0.14	0.13
	Sowing time at same spacing						0.14	0.19	0.17

Table.10 Economics of chickpea as influenced by interaction effect of sowing time and nipping under SCI

Treatments	No nipping			Nipping at 30 DAS			Nipping at 40 DAS		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
Gross return, Rs/ha									
Nov. 1st week	84748	120836	102792	90475	125759	108117	91954	128145	110050
Nov. 3rd week	90041	107136	98589	95470	111072	103271	96406	115541	105974
Dec. 1st week	72492	90104	81298	77497	93001	85249	69293	89557	79425
Dec.3rd week	60055	75150	67603	55424	67120	61272	53897	64815	59356
CD (p=0.05)	Nipping at same sowing time						2385	3576	2981
	Sowing time at same nipping						4149	4895	4522
Net return, Rs/ha									
Nov. 1st week	49078	78296	63687	52755	80409	66582	54234	82795	68515
Nov. 3rd week	54371	64596	59484	57750	65722	61736	58686	70191	64439
Dec. 1st week	36822	47564	42193	39777	47651	43714	31573	44207	37890
Dec.3rd week	24385	32610	28498	17704	21771	19738	16177	19465	17821
CD (p=0.05)	Nipping at same sowing time						2385	3576	2981
	Sowing time at same nipping						4149	4895	4522
B:C ratio									
Nov. 1st week	2.38	2.85	2.62	2.40	2.78	2.59	2.44	2.83	2.64
Nov. 3rd week	2.53	2.52	2.53	2.54	2.45	2.50	2.56	2.55	2.56
Dec. 1st week	2.03	2.12	2.08	2.06	2.05	2.06	1.84	1.97	1.91
Dec.3rd week	1.68	1.77	1.73	1.47	1.48	1.48	1.43	1.43	1.43
CD (p=0.05)	Nipping at same sowing time						0.07	0.08	0.08
	Sowing time at same nipping						0.11	0.14	0.13

Nipping time exhibited significant effect on gross return, net return and B: ratio in different sowing time (Table 10). The maximum gross return and net return was recorded in nipping at 40 days which was however statistically similar to nipping at 30 days in first and third week of November sowing time.

The average increase in net return was 3.8 to 8.3% over no nipping in November sowing of chickpea. Nipping at 30 days recorded maximum gross return and net return in first week of November sowing, moreover, net return was at par with no nipping in first week of November sowing. No nipping recorded maximum gross return and net return in third week of December sowing. Nipping caused 30.7 to 37.5 % decrease in net return over no nipping. B: ratio was recorded higher in first and third week of November sowing. Spacing and nipping time exerted significant difference in different sowing time. The maximum yield attributes, seed yield, straw yield, gross return and net return were recorded with 50x20 cm spacing and nipping at 40 days which was however statistically similar to nipping at 30 days in first and third week of November sowing. No nipping recorded maximum seed yield, straw yield, gross return and net return in third week of December sowing. Thus, in changing climate scenario, wider spacing with nipping operation at 30-40 days for higher yield and net return in early sown crop in the month of November and closer spacing of 30x20 cm spacing without nipping operation

in delayed sowing of third week of December can be practiced to minimize the losses in seed yield and net return of chickpea.

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