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Effect of sowing dates on growth and yield of chickpea varieties under late sown condition

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Abstract
The field experiment was conducted during rabi 2017-2018 at Pulse Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akolato study the effect of sowing dates on growth and yield of chickpea varieties under late sown condition. The experiment was laid out in factorial randomized block design with three replications consisting of twenty-eight treatment combinations in each. The treatments consist of four sowing dates (15thNovember, 30th November, 15th December and 30th December) and seven chickpea varieties i.e. (PDKV Kanchan, Phule Vikram, BDN 797, AKG 70, RVG 202, RVG 203 and BDN 9-3).The result of study revealed that among the four different dates of sowing 15th November sowing was recorded significantly higher growth attributes, yield attributes and yield. The chickpea crop should be sown at 15th November and most suitable variety is RVG 203 based on grain yield.

Keywords: Chickpea, varieties, sowing dates, yield

Introduction
Chickpea is cool season crop. It's yield and quality is mostly depend on climatic parameters and time of sowing. It is short durational crop and requires relatively low temperature for its optimum growth. In India, mid October to mid November is ideal period for sowing chickpea. Any deviation from this period causes conspicuous reduction in yield (Dumbre and Deshmukh, 1983) [3].
Due to global warming, temperature is increasing day by day, also the rainfall pattern is disturbed and the rainy season is extended up to first fortnight of November. As a result, duration of winter season is reduced. In such condition, there is a need to adjust the sowing date with suitable cultivars of chickpea for obtaining higher yields.

Material and Methods
The field experiment was conducted during rabi 2017-2018 at Pulse Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The experiment was laid out in factorial randomized block design with three replications consisting of twenty-eight treatment combinations in each. The treatments consist of four sowing dates (15thNovember, 30th November, 15th December and 30th December) and seven chickpea varieties i.e. (PDKV Kanchan, Phule Vikram, BDN 797, AKG 70, RVG 202, RVG 203 and BDN 9-3). The soil experimental field was clayey in texture, low available nitrogen (184.58 kg/ha), medium in available phosphorus (16.21 kg/ha) and high available potassium (375.43 kg/ha) and slightly alkaline in reaction (pH 8.2). The gross and net plot size were 3.6 x 3.00 m^2 and 3.0 x 2.8 m^2, respectively. The chickpea crop was sown as per treatment by dibbling by one seed per hill at spacing of 30 x 10 cm^2.Recommended fertilizer dose was applied. The optimum plant population was maintained by gap filling and the crop was irrigatedas per requirements. Normal cultural operations and plant protection measures were carried out as and when required.

Results and Discussion
Growth and yield contributing characters
Effect of sowing dates: The crop sown on 15th November recorded maximum plant height at par with 30th November and significantly more than later sowings 15th December and30th December. The reason for increased plant height in early sowing may be the enhanced vegetative development of crop due to the favourable weather condition. Similar results were reported by Yadav *et al.* (1999) [16], Aziz and Rahman (1996) [2], Singh *et al.* (2004) [14], Mahse *et al.* (2006) [10] and Kabir *et al.* (2009). Sowing at 15th November recorded significantly higher number of branches but was found at par with 30thNovember. Last sowing taken up on 30thDecember produced the lowest number of branches. Similar results were reported by Sharma *et al*. (1998), Aziz and Rahman (1996) [2], Yadav *et al.* (1999) [16] and Mansur *et al.* (2010) [11].

Table 1: Effect of sowing dates on growth and yield attributes of chickpea varieties under late sown condition

Treatment	Plant height (cm)	Number of branches plant^{-1}	Dry matter accumulation plant^{-1} (g)	Number of pods plant^{-1}	Weight of pods plant^{-1} (g)	Seed weight plant^{-1} (g)	100-seed weight (g)
Factor A : Sowing dates							
D_1- 15 Nov (46 MW)	42.44	19.28	18.49	39.53	11.44	9.37	22.31
D_2- 30 Nov (48 MW)	41.62	18.67	18.36	37.24	10.23	8.62	20.70
D_3- 15 Dec (50 MW)	40.97	16.29	17.09	35.33	6.84	4.17	19.15
D_4- 30 Dec (52 MW)	35.90	14.49	13.46	15.09	5.55	3.23	16.57
S.E. (m)±	0.53	0.35	0.31	0.89	0.33	0.18	0.45
C. D. at 5%	1.56	1.04	0.91	2.60	0.98	0.53	1.33
Factor B : Varieties							
V_1- PDKV Kanchan	43.92	17.13	16.02	31.83	8.49	5.69	19.77
V_2- Phule Vikram	42.46	17.56	17.46	32.23	8.64	6.20	19.55
V_3- BDN 797	35.92	15.01	16.26	30.98	7.63	5.88	20.34
V_4- AKG 70	42.76	14.81	15.77	29.35	7.55	5.51	20.20
V_5- RVG 202	39.08	20.95	18.79	34.95	9.05	6.93	19.63
V_6- RVG 203	36.69	22.99	21.08	35.71	9.41	7.34	20.70
V_7- BDN 9-3	39.40	19.82	17.80	33.51	8.83	6.90	18.59
S.E. (m) ±	0.70	0.47	0.41	1.17	0.44	0.24	0.60
C.D. at 5%	2.06	1.37	1.20	3.43	1.29	0.70	NS
Interaction (AXB)							
S.E. (m) ±	1.41	0.93	0.82	2.34	0.88	0.48	1.20
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS
GM	40.61	17.18	17.60	32.34	8.51	6.35	19.68

The significantly higher dry matter accumulation plant^{-1}(g) was recordedat 15th November sowing which was statistically at par with 30th November. Decreased with later sowing (15th December and 30th December), Sowing of 30thDecember recorded the least dry matter accumulation. This could be attributed to comparatively less favourable weather conditions encountered across the growing period by later sown crop with consequently reduced dry matter accumulation. Besides, growth period of the crop also decreased with each successive delay in sowing which also reflected in reduced dry matter accumulation in later sowings. Earliest sowing dates encountered more optimum environmental conditions and allowed the plant to accumulate more dry matter accumulation. According to Yadav *et al.* (1999) [16], vegetative growth continued into the reproductive stage for longer under normal than late sowing. Aziz and Rahman (1996) [2] also observed that number of days to flowering decreased with delay in sowing. This corroborates the findings of Ganguly and Bhattacharya (2001) [5], Kumar *et a*l. (2006) [8], Kiran and Chimmad (2015) [7] as well.

Significantly higher mean number of pods plant^{-1}(39.53) at harvest was recorded at sowing on 15th November, it was statistically at par with 30th November and was significantly superior over 15th December and 30th December. The highest mean weight of pods plant^{-1} (11.44 g) was recorded by 15th November sowing, It was significantly superior over rest of the treatments. The lowest weight of pods plant^{-1} (5.55 g) was recorded by 30th December sowing date.

Significantly the higher mean seed weight plant^{-1} (9.37 g) was recorded by 15th November sowing date over all other sowing dates. Weight of 100 seed was significantly influenced due to sowing time. The maximum hundred seed weight (22.31 g) was recorded by 15th November, each delayed sowings recorded significantly lower 100 seed weight which indicated better seed development in earlier sowings.

The above results are in conformity with Aziz and Rahman (1996) [2], Kumar *et a*l. (2003) [9] Shelke *et al.* (2015) [15]. Overall greater yield attributes in earlier sown crops shows greater encouragement for reproductive growth due to more favourable weather condition as compared to later sown crops.

Mean plant height was significantly influenced due to varieties. The variety PDKV Kanchan showed significantly higher plant height, which was statistically at par with variety AKG 70 and Phule Vikram. Among the seven chickpea varieties, BDN 797 recorded lowest plant height during all the growth stages. The mean number of branches was significantly varied with different varietal treatments. Variety RVG 203 was significantly superior in number of branches per plant over rest of the varieties. The lowest number of branches was noticed in variety AKG 70. The significant different was found in dry matter accumulation plant^{-1}(g) due to different varieties. The variety RVG 203 was significantly superior in dry matter accumulation plant^{-1}(g) over rest of the varieties. The lowest dry matter accumulation was recorded by variety
AKG 70.

Effect of varieties: At harvest, Variety RVG 203 recorded significantly maximum number of pods plant^{-1} (35.71) than all varieties but was found at par with variety RVG 202 and variety BDN 9-
3. Lowest number of pod plant^{-1} (29.35) was observed in AKG 70. Significantly higher mean weight of pods plant^{-1} (9.41 g) was recorded in RVG 203, but it was found at par with variety RVG 202, BDN 9-3, Phule Vikram and variety PDKV Kanchan. Lowest weight of pods plant^{-1} (7.55 g) was observed in variety AKG. Similarly the variety RVG 203 recoded higher weight of pods (7.34 g) plant^{-1} but was found statistically at par with variety RVG 202 and BDN
9-3. Lowest weight of pods plant^{-1} was observed in variety AKG-70 (5.51 g). Hundred seed weight was found to be non-significant due to different varieties.

Interaction effect: The interaction effect between sowing dates and varieties were found to be non-significant at all the growth and yield contributing characters.

Yield and economics

Effect of sowing dates: Different sowing time had a profound influence on the grain yield. Significantly superior grain yield (1737 kg ha^{-1}) was obtained when crop was sown on 15thNovember than later sowing time of 30thNovember,

15th December and 30thDecember. Crop sown on 30thDecember recorded the lowest grain yield (653 kg ha-1). The mean values were higher when the crop was sown on 15thNovember for all vegetative and reproductive attributes indicating that 15thNovember sowing enabled the crop to express the inherent potential to the maximum as compared to later sowings. Other authors Faroda and Singh (1992) [14], Ganguly and Bhattacharya (2001) [5] have noted similar decisive effect of sowing time on chickpea growth and development and reported reductions in various morpho-physiological attributes with delayed sowing due to less favourable weather variables.

There was significant variation in mean straw yield due to sowing dates. The higher straw yield recorded by 15th November sowing date, which was found to be on par with sowing on 15th December. The lowest straw yield (978 kg ha-1) recorded on 30thDecember. Similar results were reported by Tiwari and Meena (2014) [15], Nikam *et al* (2014) [12], and Ali *et a*l. (2018) [1]. Crop sown on 15th November, observed significantly superior biological yield (3857 kg ha-1) over rest of the sowing dates. The lowest biological yield (1634 kg ha-1) was recorded on 30th December. The results are in line with the findings of Yadav *et al.* (1999) [16], Ali *et a*l. (2018) [1]. Wherein reduced total biomass was observed with later sowing. The highest mean harvest index (45.06%) was recorded at 15th November sowing date which in general decreased with successive later sowings. The lowest value of harvest index was recorded at 30th December sowing date. Higher harvest index in earlier sown crops could be due to comparatively better translocation efficiency. Similar result obtained by Kabier *et al.* (2009) [6] and Ali *et al.* (2018) [1].

Table 2: Effect of sowing dates on yield and economics of chickpea varieties under late sown condition

Treatment	Grain Yield (kg/ha)	Straw yield (kg/ha)	Biological yield (kg/ha)	Harvest Index (%)	Cost of cultivation (Rs ha-1)	Gross monetary return (Rs ha-1)	Net monetary return (Rs ha-1)	Benefit: cost ratio
Factor A : Sowing dates								
D1- 15 Nov (46 MW)	1737	2120	3857	45.06	23092	78938	55846	3.42
D2- 30 Nov (48 MW)	1578	2000	3579	44.13	23092	71957	48865	3.12
D3- 15 Dec (50 MW)	1442	1969	3412	42.29	23092	65958	42866	2.86
D4- 30 Dec (52 MW)	653	978	1634	40.13	23092	31273	8181	1.35
S.E. (m)±	14.84	24.33	39.05	0.51		716	718	-
C.D. at 5%	43.53	71.35	114.52	1.49		2102	2107	-
Factor B : Varieties								
V1- PDKV Kanchan	1319	1733	3053	42.72	23092	60562	37470	2.62
V2- Phule Vikram	1354	1818	3172	42.21	23092	62105	39013	2.69
V3- BDN 797	1313	1708	3025	43.12	23092	60294	37202	2.61
V4- AKG 70	1207	1559	2766	43.12	23092	55645	32553	2.41
V5- RVG 202	1416	1842	3258	43.02	23092	64811	41719	2.81
V6- RVG 203	1460	1875	3337	43.28	23092	66758	43666	2.89
V7- BDN 9-3	1398	1834	3232	42.83	23092	64049	40957	2.77
S.E. (m) ±	19.63	32.18	51.65	0.67		948	950	-
C. D. at 5%	57.59	94.39	151.50	NS		2780	2788	-
Interaction (AXB)								
S.E. (m) ±	39.27	64.36	103.30	1.34		1896.15	1901.41	-
C.D.at 5%	115.17	NS	NS	NS		NS	NS	NS
GM	1353	1767	3120	42.90	23092	62032	38940	

The total cost of cultivation was same for all treatments. It was Rs 23092ha-1. The gross monetary returns were significantly influenced by different sowing dates. Significantly higher gross monetary return (Rs 78938/ha) was obtained by crop sown at 15th November over rest of the sowing dates. The lowest value of gross monetary returns was recorded on sowing time 30th December (Rs 31273.91ha-1). The net monetary return was significantly influenced with sowing dates. The highest net monetary return (Rs 55846ha-1) was recorded by 15th sowing over rest of the sowing dates. The highest benefit: cost ratio (3.42) was recorded at 15th November sowing. The lowest value was recorded at 30th December sowing treatment.

Effect of varieties: There was statistically significant variation in seed yield due to varieties. The highest grain yield (1460 kg ha-1) was recorded in variety RVG 203 which was found at par with variety RVG 202. However lowest grain yield (1207 kg ha-1) was produced by variety AKG 70. Difference in straw due to different varieties was significant. Variety RVG 203 recorded significantly higher straw yield (1875 kg ha-1), which was at par with variety RVG 202, BDN 797, and Phule Vikram. The lowest straw yield (1559 kg ha-1) observed in variety AKG 70. Differences in biological yield due to different varieties were significant. Variety RVG 203 recorded significantly higher biological yield (3337 kg ha-1) which was at par with variety RVG 202, and BDN 797. The lowest biological yield (2766 kg ha-1) observed in variety AKG 70. Differences in harvest index due to different varieties were found to be non-significant.

The cost of cultivation for all varieties, was Rs. 23092 ha-1. Chickpea variety RVG 203 significantly recorded higher gross monetary returns of (Rs 66758 ha-1) as compared to remaining varieties. The highest net monetary return (Rs 43666 ha-1) was recorded by RVG 203 variety over rest of the varieties. The highest benefit: cost ratio (2.89) was recorded in RVG 203 variety at rest of the varieties. The lowest value of benefit: cost ratio (2.41) was recorded in AKG 70.

Interaction effect: The interaction effect between sowing dates and varieties were found to be non significant in straw yield, biological yield and harvest index except in grain yield it was significant.

Table 3. Effect of sowing dates on meteorological parameters

Factor A : Sowing dates	Growing Degree Days (^{0}C day)	Heliothermal units (^{0}C day^{-1} hr^{-1})	Thermal use efficiency (kg ha^{-1} ^{0}C day^{-1})		
			Grain yield	Straw yield	Biological yield
D_1- 15 Nov (46 MW)	1732	12127	1.01	1.23	2.23
D_2- 30 Nov (48 MW)	1722	11958	0.99	1.22	2.21
D_3- 15 Dec (50 MW)	1692	11619	0.97	1.20	2.17
D_4- 30 Dec (52 MW)	1570	10740	0.96	1.20	2.15
Factor B: Varieties					
V_1- PDKV Kanchan	1722	11911	0.76	1.00	1.75
V_2- Phule Vikram	1751	12060	0.76	1.03	1.79
V_3- BDN 797	1651	11426	0.79	1.03	1.82
V_4- AKG 70	1657	11521	0.72	0.93	1.66
V_5- RVG 202	1662	11489	0.84	1.10	1.94
V_6- RVG 203	1621	11212	0.89	1.15	2.04
V_7- BDN 9-3	1687	11657	0.82	1.08	1.90
Interaction (AXB)					
GM	1679	11611	0.76	1.00	1.75

Meteorological parameters

Effect of sowing dates: The higher value of GDD was recorded at 15th November sowing treatment over rest of the sowing dates. The lowest value of GDD was recoded at 30th December sowing. The requirement of heat units (GDD) was higher for normal growing condition than late sowing condition. This was due to longer period for all the phenological stages in early sowing condition. Late sowing decreased the duration phenology as compared to early sowing due to fluctuated unfavourable high temperature during the growing period. So, the requirement of heat units decreased for different phenological stages with late sowing. Chand *et al*. (2010), Kiran and Chimmad (2015) [7]. chickpea crop sown on 15th Nov had recorded significantly moreheliothermal units (12127 ^{0}C day^{-1} hr^{-1}) than all other sowing dates. This was might be due to delayed maturity in early sown crop compare to late sown crop. Amongst the sowing dates, thermal use efficiency in terms of grain yield (1.01 kg ha^{-1} ^{o}C day^{-1}), straw yield (1.23 kg ha^{-1} ^{o}C day^{-1}) and biological yield (2.23 kg ha^{-1} ^{o}C day^{-1}) was more with 15th November sowing. It was closely followed by 30th November sowing. Sowing on 30th December recorded the least thermal use efficiency in terms of grain yield (0.96 kg ha^{-1} ^{o}C day^{-1}), straw yield (1.20 kg ha^{-1} ^{o}C day^{-1}), and biological yield (2.15 kg ha^{-1} ^{o}C day^{-1}).

Effect of varieties: Growing degree day (GDD) and heliothermal units (HTU) availed across the observed phenophases from sowing to maturity were comparatively higher in variety Phule Vikram (1751 ^{0}C day) and (12060 ^{0}C day^{-1} hr^{-1}) respectively, followed by PDKV Kanchan. The lowest (GDD) and heliothermal units (HTU) (1621 ^{0}C day) and (11212 ^{0}C day^{-1} hr^{-1}) respectively was observed in variety RVG 203. This was due to comparatively longer growth duration of crop coupled with greater sunshine hours in the respective sowing date and for the respective variety caused higher accumulation Growing degree day (GDD) and heliothermal units (HTU). in case of thermal use efficiency the variety RVG 203 recorded the highest thermal use efficiency in terms of grain yield (0.89 kg ha^{-1} ^{o}C day^{-1}), straw yield (1.15 kg ha^{-1} ^{o}C day^{-1}), and biological yield (2.04 kg ha^{-1} ^{o}C day^{-1}) over rest of the varieties. The lowest thermal use efficiency in terms of grain yield (0.72 kg ha^{-1} ^{o}C day^{-1}), straw yield (0.93 kg ha^{-1} ^{o}C day^{-1}), and biological yield (1.66 kg ha^{-1} ^{o}C day^{-1}) was observed in AKG 70. The higher yield in RVG 203 was due to higher thermal use efficiency which reflected in yield.

Conclusion

Based on the above results, it can be concluded that chickpea sowing on 15th November produces higher seed yield and variety RVG 203 and RVG 202 were found suitable under late sown condition.

References

1. Ali Y, Biswas PK, Shahriar SA, Nasif SO, Raihan RR. Yield and quality response of chickpea to different sowing dates. Asian Journal of Research in Crop Science. 2018; 1(4):1-8.
2. Aziz MA, Rahman MM. Response of nabin chickpea to different dates of sowing. Bangladesh J of Scientific and industrial Res. 1996; 31(3):103-109.
3. Dumbre AD, Deshmukh RB. Yield of gram varieties as affected by sowing dates, fertilizer application and irrigation. J Maharashtra Agric. Univ. 1983; 8(3):300.
4. Faroda AS, Singh RC. Effect of varieties, sowing dates and soil fertility on gram production under rainfed conditions. Trans. of Indian Soc. Desert Technology Center. 1982; 7(2):6-8.
5. Ganguly SB, Bhattacharya A. Effect of physiological traits on chickpea yield under normal and late seeding. Legume Res. 2001; 24(1):6-10.
6. Kabier K, Bari MN, Karim M, Khaliq Q, Ahmed J. Effect of sowing time and cultivars on the growth and yield of chickpea under rainfed condition. Bangladesh J Agric. Res. 2009; 34(2):335-342.
7. Kiran BA, Chimmad VP. Effect of temperature regimes on phenological parameters, yield and yield components of chickpea. Karnataka J Agric. Sci. 2015; 28(2):168-171.
8. Kumar S, Kumar M, Kadian VS. Biomass partitioning and growth of chickpea as influenced by sowing dates. Agrochemicals and Cultivars. 2006; 25(4):25.35.
9. Kumar S, Kumar M, Singh RC, Kadian VS. Effect of sowing dates on yield of chickpea (*Cicer arietinum* L.) genotypes. Tests of Agrochemicals and Cultivars. 2003; 23:22-23.
10. Mahse LB, Deshmukh DV, Jamadagni BM. Varietal improvement of chickpea for rainfed and late sown conditions. Ann. Pl. Physiol. 2006; 20(2):177-180.
11. Mansur CP, Palled YB, Halikatti SI, Chetti MB, Salimath PM. Effect of dates of sowing and irrigation levels on biometric growth parameters of kabuli chickpea. Karnataka J Agril. Sci. 2010; 23(4):566-569.

12. Nikam RP, Bhondave TS, Raundal PU. Effect of various sowing date on growth and yield of chickpea. Bioinfolet. 2014; 11(3A):9-14.
13. Shelke SS, Bharud RW, Nagawade DR. Response of Chickpea Genotypes (*Cicer arietinum* L.) to Sowing Dates. Bioinfolet. 2015; 12(3A):610-614.
14. Singh TK, Dwivedi RP, Singh SK, Verma SN. Response of varieties and dates of sowing on growth and yield of chickpea (*Cicer arietinum* L.). Plant Archives. 2004; 4(2):471-474.
15. Tiwari D, Meena VD. Effect of sowing dates and weed management on growth and yield of chickpea in Indo-Gangetic plains. Proc. Natl. Acad. Sci., India, Sect. B Biol. Sci. 2014; 2(1):114-122.
16. Yadav VS, Yadav SS, Singh DS, Panwar D. Morpho-physiological basis of yield varieties in chickpea under late planting conditions. Ann. Agric. Res. 1999; 20(2):227-230.