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Effect of sowing dates and varieties on nutrient uptake and yield of chickpea

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Abstract
The field experiment was conducted during *rabi* 2017-2018 at Pulse Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola to study effect of sowing dates and varieties on nutrient uptake and yield of chickpea under late sown condition. The result shown that nutrient uptake and yield were depending on time of sowing. The nutrient uptake patterns showed that the first sowing date plants recorded greater nutrient uptake compared to remaining sowing dates in experiments. Among the varieties RVG 203 recorded the highest nutrient uptake followed by RVG 202.The lowest nutrient uptake was recorded in AKG 70. This study concluded that late sowing will reduce the nutrient uptake, dry matter accumulation and yield irrespective of the varieties. Among the varieties the highest yield was recorded by variety RVG 203 irrespective of the date of sowing. And hence under late sowing conditions the variety RVG 203 is preferred over other varieties.

Keywords: Chickpea, cultivars, sowing date, nutrient uptake, weather

Introduction
Climate change impact is a major concern for winter crops like chickpea where irrigation facility is very much limited. Chickpea (*Cicer arietinum* L.) is the most important pulse crop of rabi season cultivated mainly in semiarid and warm temperate regions of the world. It produces 126 kg protein from one hectare and is probably the highest protein yielding grain legume except, groundnut and soybean. In India, chickpea cultivation being restricted mainly to rainfed areas or cultivated under residual moisture, lack of nutrient management, instability of yield, low harvest index, inadequate management practices, higher incidence of pests and diseases and faulty management of pest and diseases. Chickpea meets 80% of its nitrogen requirement from symbiotic nitrogen fixation and can fix up to 140 kg N from air. The fixed N not only can meet the requirements of the legume for maximum grain formation, but can also be available for use by subsequent crops, after mineralization of chickpea crop residues. But the P and K nutrition is mainly met through applied fertilizers. The performance of the crop mainly depended on the cultivar performance and the environmental area where it is growing. As far as a variety is considered its optimum time of sowing has a crucial role in fully utilizing the genetic potentiality as it provides the best possible growing conditions such as light, temperature, rainfall, humidity. It was reported that the main causes of yield component variability are genotypic, genotype by environment interactions and climatic variability in terms of temperature regime and moisture availability. Unlike other winter growing legumes, chickpea is very susceptible to low temperatures, especially at flowering. In chickpea sowing date is one of the most important agronomic factors affecting chickpea productivity. The environmental factors which determine optimum sowing date are the pattern of moisture availability during plant growth, temperature and photoperiod. In a given region, the optimum sowing date depends mainly upon the timing of rainfall. Chickpea cultivation is absolutely dependent on soil moisture reserve where planting is made late during the recession of the main rainy season to escape the waterlogging condition. Proper agronomic management practices also need to be identified to help the crop adjust to the changing environment. The uptake of nutrients and yield of varieties in the changing weather factors helps to select the most promising varieties in terms of yield and nutrient use efficiency. With this view field experiments were conducted to identify the most suitable variety, appropriate sowing time and their subsequent interaction on nutrient uptake and yield performance in chickpea under varying environment.

Materials and Method
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 (15th November, 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 irrigated as per requirements. Normal cultural operations and plant protection measures were carried out as and when required.

Results and Discussion

Effect of sowing dates on nutrient uptake

Result of experiment revealed that sowing date significantly influenced the total nitrogen uptake. Sowing on 15th November recorded significantly highest uptake of nitrogen, phosphorus, potassium and micronutrient like Fe, Mn, Zn, Cu by seed, straw and total uptake by chickpea crop as compared to sowing on 30thNovember, 15th December and 30th December. The lowest uptake was recorded by sowing on 30th December. There was a reduction in the nitrogen uptake in each successive delay sowing. The delay in sowing might result the seeds to face a more dry soil environment in the later growing periods and hence affected the growth and biomass production, led to low nutrient uptake. Similar result reported by Dass (2010), Neenu *et al*. (2017) [7], Ray *et al*. (2017) [8].

Effect of varieties on nutrient uptake

Nutrient uptake was significantly differed due to different varieties. Highest nitrogen, phosphorus, potassium and micronutrients (Fe, Mnand Zn) uptake by seed, straw and total uptake by crop were recorded by variety RVG 203, followed by RVG 202, and BDN 9-3. The lowest nutrient uptake was recorded in variety AKG 70.t

Effect of sowing dates on growth and yield.

Sowing time influenced dry matter accumulation significantly. Dry matter weight plant^{-1} showed decreasing trend with each successive delay sowing. 15th November sowing accumulated higher dry matter weight plant^{-1} compared to later sowings 30th November, 15th December and 30th December. Sowing on 30th December 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) [9], vegetative growth continued into the reproductive stage for longer under normal than late sowing. Aziz and Rahman (1996) [1] also observed that number of days to flowering decreased with delay in sowing. This corroborates the findings of Kiran and Chimmad (2015) [6] as well.

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 15th November than rest of the sowing dates. The lowest grain yield (653 kg ha^{-1}) was obtained when crop sown at 30th December. The mean values were higher when the crop was sown on 15th November for all vegetative and reproductive attributes indicating that 15th November sowing enabled the crop to express the inherent potential to the maximum as compared to later sowings. Other authors Faroda and Singh (1992) [4], Dahiya *et al.* (1998), 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.

Effect of varieties on growth and yield

Differences in dry matter accumulation plant^{-1} due to varieties were significant. The differential dry matter accumulation among varieties may mainly be attributed to their genetic potential rather than the effect of external weather parameters which prevailed more or less in similar range along the growing period of varieties. Maximum dry matter accumulation plant^{-1} was observed in variety RVG 203 which was significantly superior over rest of the varieties. Variety AKG 70 recorded lowest dry matter accumulation. The highest grain yield (1460 kg ha^{-1}) was recorded in 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.

Conclusion

From the present investigation it is concluded that sowing at 15th November was better than rest of the sowing dates in experiment. Also it was convinced that late sowing would reduce the nutrient uptake, dry matter production and yield irrespective of the varieties. Among the varieties the highest yield was recorded by the variety RVG 203 irrespective of the date of sowing. Hence it is suggested that the variety RVG 203 could be preferred over other varieties to get high yield under late sown condition.

Table 1: Yield and nutrient uptake in grain and straw of chickpea as influencedby different treatments

Treatment	Grain Yield (kg/ha)	Straw yield (kg/ha)	N Uptake (g ha^{-1})			P Uptake (g ha^{-1})			K Uptake (g ha^{-1})			Mn Uptake (g ha^{-1})			Zn Uptake (g ha^{-1})		
			Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total
D_1-15 Nov (46MW)	1737	18.49	57.85	48.26	106.12	8.98	7.14	16.12	17.20	39.71	56.91	58.98	40.90	99.88	60.73	37.00	97.74
D_2- 30 Nov (48MW)	1578	18.36	51.42	44.48	95.90	7.17	6.21	13.38	15.15	35.89	50.62	52.92	36.91	89.83	54.17	33.90	88.07
D_3- 15 Dec (50MW)	1442	17.09	46.48	42.83	89.31	6.00	5.54	11.54	13.56	35.47	49.45	46.81	36.11	82.92	48.27	32.87	81.15
D_4-30 Dec (52 MW)	653	13.46	20.54	18.50	39.04	2.62	2.05	2.67	5.95	16.48	22.43	20.62	17.04	37.66	20.99	16.10	37.09
S.E. (m)±	14.84	0.31	0.84	0.67	1.15	0.01	0.02	0.02	0.15	0.43	0.51	0.11	0.10	0.16	0.12	0.09	0.16
C. D. at 5%	43.53	0.91	2.45	1.96	3.38	0.04	0.05	0.07	0.45	1.25	1.50	0.32	0.27	0.46	0.33	0.25	0.45

Factor B : Varieties																	
V_1- PDKV Kanchan	1319	16.02	42.35	36.98	79.33	5.71	5.04	10.75	11.35	31.30	42.65	43.44	32.19	75.63	44.82	29.19	74.00
V_2- Phule Vikram	1354	17.46	44.05	39.58	83.63	6.03	5.73	11.76	12.06	32.26	44.32	44.71	33.74	78.46	45.95	30.85	76.80
V_3-BDN 797	1313	16.26	41.54	35.24	76.78	5.18	5.16	10.34	11.43	28.89	40.32	43.16	31.16	74.31	43.92	28.38	72.30
V_4-AKG 70	1207	15.77	37.59	31.70	69.29	4.40	4.15	8.55	10.27	26.08	36.35	39.25	28.46	67.71	40.23	25.89	66.12
V_5-RVG 202	1416	18.79	47.81	41.65	89.46	6.82	6.48	13.30	13.74	33.86	47.60	46.94	34.37	81.31	48.72	31.69	80.41
V_6-RVG 203	1460	21.08	48.93	43.26	92.19	7.47	6.96	14.43	14.31	36.60	50.91	49.41	35.14	84.55	50.45	32.55	83.00
V_7-BDN 9-3	1398	17.80	46.25	41.22	87.47	6.13	6.10	12.23	13.29	34.23	47.52	46.91	34.13	81.04	48.22	31.65	79.87
S.E. (m) ±	19.63	0.41	1.11	0.88	1.52	0.09	0.10	0.15	0.20	0.56	0.67	0.69	0.59	0.99	0.71	0.53	0.97
C. D. at 5%	57.59	1.20	3.24	2.59	4.47	0.24	0.29	0.42	0.57	1.60	1.91	1.95	1.66	2.80	2.00	1.51	2.74
Interaction (AXB)																	
S.E. (m) ±	39.27	0.82	2.21	1.77	3.05	0.17	0.20	0.29	0.40	1.13	1.35	1.38	1.17	1.98	1.41	1.07	1.93
C. D. at 5%	115.17	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
GM	1353	17.60	43.86	38.51	82.59	5.96	5.66	11.62	16.56	31.89	48.45	44.83	32.74	77.57	46.04	29.97	76.01

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