Indian J. Agron. 38 (2) : 227–231 (June 1993)

Effect of sowing date and irrigation on yield and nutrient uptake by chickpea (*Cicer arietimum*) cultivars under Tawa Command area

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Received: December 1991

ABSTRACT

A field experiment was conducted during the winter seasons of 1985–86 and 1986–87 at Powarkheda, to study the effect of sowing date and irrigation on yield and nutrient uptake by chickpea (*Cicer arietinum* L.) on clay soil. The highest seed yield and nutrient uptake were recorded in 16 November sowing. Irrigation at irrigation water depth : cumulative pan evaporation ratio of 0.8 had a marked influence on the grain yield as well as nutrient uptake during both the years. 'Radhey' performed better than 'Ujjain 21' chickpea.

Lack of suitable high-yielding varieties and management of crop under water-constraint conditions is the main reason for low yield of chickpea (*Cicer arietinum* L.). Timely sowing of crop is the most important non-monetary input for higher crop productivity (Masood Ali and Kushwaha, 1985). Irrigation increases the yield as well as nutrient uptake (Kulhare *et al.*, 1988). Information on the performance of high-yielding cultivars in respect of optimum irrigation levels with suitable dates of sowing is meagre, and hence the present investigation was undertaken.

MATERIALS AND METHODS

A field study was carried out at Powarkheda during the winter seasons of 1985–86 and 1986–87. The experiment was laid out in split-plot design with 3 replications. The main-plot treatments consisted of 4 irrigation schedules [irrigation water depth : cumulative pan evaporation (IW : CPE) ratios of 0.0, 0.4, 0.6 and 0.8] and 5 dates of sowing (5 October, 26 October, 16 November, 7 December and 28 December), and subplot treatments had 2 cultivars ('Ujjain 21' and 'Radhey'). The experimental soil was clay with pH 8.1 and organic carbon content 0.552%, field capacity 34% and wilting point 16%. The available N, P and K were 283.6, 10.4 and 193.8 kg/ha respectively. The meteorological data during the crop period is presented in Fig. 1. A basal dose of 20 kg N, 80 kg P_2O_5 and 20 kg K_2O/ha was applied in furrows at the time of sowing. Inter- and intra-row spacings of 30 and 7 cm respectively were maintained. The rainfall received during the crop season of 1985–86 and 1986–87 was 254.4 and 114.0 mm respectively. One come-up irrigation was

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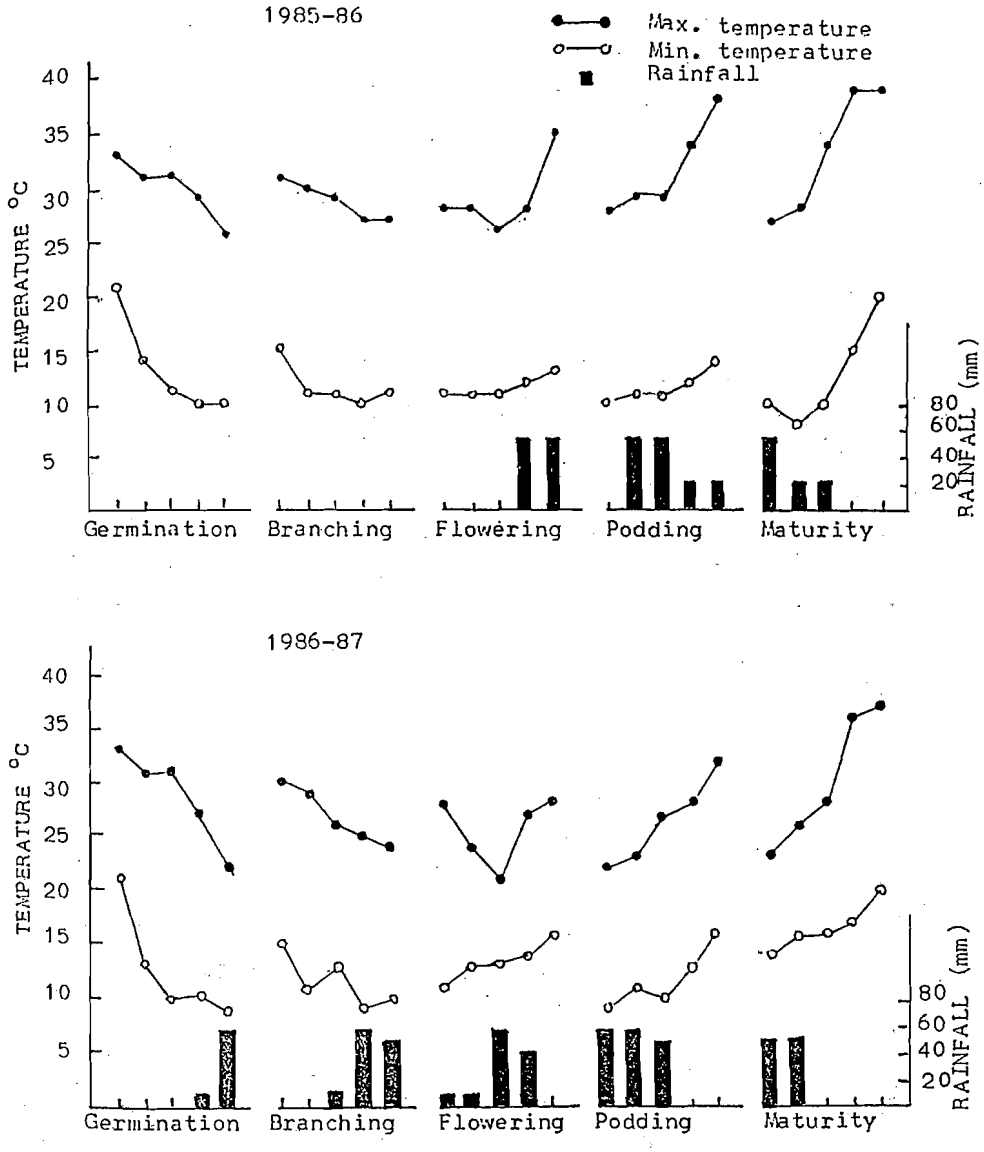

Fig. 1. Maximum and minimum temperature and rainfall during different stages of growth in chickpea

Table 1. Dry-matter production, seed yield, protein yield and N, P and K uptake in gram as influenced by sowing date, irrigation level and cultivar (mean data of 2 years)

Treatment (kg/ha)	Dry-matter production (kg/ha)	Grain yield (kg/ha)	Protein yield (kg/ha)	N uptake (kg/ha)		P uptake (kg/ha)		K uptake (kg/ha)	
				Grain	Straw	Grain	Straw	Grain	Straw
Sowing date									
5 Oct	54.38	15.11	498	63.67	32.63	5.21	3.34	13.05	21.69
26 Oct	66.45	18.98	579	82.11	40.82	6.58	4.17	16.05	25.04
16 Nov	66.82	19.25	557	80.37	39.14	6.59	4.45	15.17	30.19
7 Dec	52.80	14.41	391	61.56	32.01	5.54	3.28	13.70	23.48
28 Dec	46.89	10.90	317	44.39	23.59	4.66	2.57	10.18	21.38
CD (P 0.05)				8.64	3.80	1.05	0.65	2.76	4.13
Irrigation									
No irrigation	38.82	11.25	200	43.78	22.62	3.98	2.29	9.70	11.17
0.4 IW : CPE	54.43	15.54	295	64.94	31.78	3.27	3.14	12.51	22.32
0.6 IW : CPE	64.85	17.50	348	75.22	38.64	6.36	4.05	15.42	27.05
0.8 IW : CPE	71.70	18.66	368	81.91	41.49	7.18	4.81	16.45	32.65
CD (P = 0.05)				7.73	3.39	0.94	0.38	2.31	4.24
Cultivar									
'Ujjain 21'	38.77	15.86	299	52.49	31.98	5.46	3.82	12.59	23.56
'Radhey'	42.79	17.32	339	57.80	35.89	5.94	3.82	28.91	25.72
CD (P = 0.05)				NS	NS	0.28	0.27	2.03	1.01

NS, Non-significant
IW : CPE, Irrigation water depth : cumulative pan evaporation

given uniformly to all the treatments for proper germination.

RESULTS AND DISCUSSION

Effect of sowing date

Date of sowing influenced the seed yield significantly (Table 1). Delay in sowing caused a significant reduction in seed yield. Highest seed yield was recorded in 16 November sowing, However, the yield differences were not significant in respect of 16 November and 26 October sowings in both the years. This may be due to the prevalence of favourable temperature at sowing time and longer optimum period for crop growth. The late-planted corp is subjected to relatively lesser time span available for plant growth and development. Thus, sowing of chickpea beyond or before its optimum period causes reduction in grain yield. The present findings are in close conformity with those of Masood Ali and Kushwaha (1985). Similar trend was noticed for dry-matter production and protein yield in both the years. Protein yield was 317–579 kg/ha (on pooled basis) under various dates of sowing. The nutrient uptake (N, P and K) in grain, stalk and total plant were significant with 26 October sowing, followed by 16 November sowing. This may be due to the increased dry-matter production.

Effect of irrigation

Chickpea responded significantly to levels of irrigation in both the years. Increase in frequency of irrigations from no irrigation to 0.6 and 0.8 IW : CPE ratios resulted in significant increase in grain yield during 1985–86 and 1986–87 respectively (Table 1). On the basis of mean, the maximum grain yield and dry matter were 18.66 and 71.70 q/ha respectively with irrigation at an IW : CPE ratio of 0.8, which were significantly higher than those of lower ratios. Irrigation had a market influence on nutrient uptake, viz. nitrogen, phosphorus and potash, during both the years. The N, P and K uptake in grain, stalk and total plants were the highest with an IW : CPE ratio of 0.8, followed by lower levels (Table 1). The maximum uptake of NPK at 0.8 IW : CPE was primarily due to the higher nutrient concentrations as well as higher grain yield at this level. These results corroborate the findings of Ghosh and Ghosh (1982) and Kulhare *et al.* (1988). Protein yield increased significantly with increase in irrigation frequency up to 0.6 IW : CPE ratio. However, irrigations at 0.6 and 0.8 IW : CPE ratios were at par.

Effect of cultivar

Dry matter and grain yield were significantly higher in 'Radhey', followed by 'Ujjain 21'. Similarly, 'Radhey' gave significantly highest protein yield (Table 1). It is due to higher N content in grain and grain yield in 'Radhey' variety. The results confirm the findings of Masood Ali and Kushwaha (1985) and Verma and Yadav (1988). On the basis of average removal of nutrients, 'Radhey' removed more N, P and K than 'Ujjain 21'. 'Radhey' removed 10.12, 10.35 and 16.77% more N, 8.79, 14.37 and 11.03% more P and 14.77, 7.25 and 10.04% more K in grain, straw and total plants respectively than 'Ujjain 21'. This was mainly due to higher grain and straw yields given by 'Radhey'.

It was concluded that sowing of 'Radhey' chickpea between 25 October and 16 November with irrigation at 0.8 IW : CPE ratio would be beneficial under irrigated Vertisol in Central Narmada Valley.

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