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Short communication

Studies on the effect of weather and irrigation on yield and yield attributes of chickpea under Raipur condition

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Abstract
The present investigation entitled "studies on the effect of weather and irrigation on Yield and yield attributes of chickpea under Raipur condition." was conducted during *rabi* season 2013-14 at Research Farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh). Regarding yield and yield attributes it was found that the grain yields between different treatments were significantly different except between D_1 and D_2 under unirrigated condition. Based on the data it was concluded that the sowing of chickpea under Raipur condition should not be done beyond 20th November both under irrigated and unirrigated conditions. The number of seed/m2 difference between D_1 and D_2 under irrigated condition is very highly significance. The difference between D_1 unirrigated and D_2 unirrigated is not significant. In other treatments the difference is highly significant. Thus the sowing data under unirrigated conditions could be extended till 20th November under Raipur conditions. The highest dry matter accumulation was observed at maturity in D_1 irrigated (777.2 gm/m2) treatment followed by D_1 unirrigated, D_2 irrigated and unirrigated. Lowest dry matter accumulation was observed in D3 under unirrigated (248.2 gm/m2). Dry matter production reached almost plateau during maturity of the crop.

Keywords: weather, irrigation, attributes, Raipur condition

Introduction
Climate and weather conditions which influence human activities and environmental resources sustainability include; rainfall, temperature (minimum, average, maximum), pressure, humidity, solar radiation, visibility, evaporation, soil temperature at various depths, wind speed and direction among others. The climate is the least manageable part of environmental resources, yet a better understanding of the climatic resources and their interaction with crops can help to increase the crop productivity. Pulses are important sources of dietary protein and have unique property of maintaining and restoring soil fertility through biological nitrogen fixation as well as conserving and improving physical property of soil by virtue of their deep root system and leaf fall. It leaves behind reasonable quantity of nitrogen in the soil and add up to 30 kg N/ha. to soil. (Anonymous, 2006) [1].

Pulses in India have long been considered as the poor man's major source of protein. Pulses are grown in about 22-23 million hectares of area with an annual production of 13-17 million tones in India. India accounts for 33% of the world area and 22% of the world production of pulses. The major pulse crops grown in India are chickpea, pigeon pea, lentil, green gram, black gram and field pea. About 90% of the global pigeon pea, 65% of chickpea and 37% of lentil area falls in India, corresponding to 93%, 68% and 32% of the global production, respectively (FAOSTAT 2011) [2]. Chickpea (*Cicer arietinum* L.) is one of the most important grain legumes which is traditionally cultivated in marginal areas and saline soils (Rao *et al.*, 2002) [5]. Chickpea (*Cicer arietinum* L.) is third most widely grown grain legume in the world after bean and soyabean. The important processes are growth and development, growth parameters, metabolism, biomass, physiological maturity and yield. Growing degree days are used to assess the suitability of a region for production of a particular crop, determine the growth stages of crops, assess the best timing of fertilizer, herbicide and plant growth regulators application, estimate heat stress accumulation on crops, predict physiological maturity and harvest dates and ideal weather unit in constructing crop weather models. (Parthasarathi *et al.*, 2013) [4].

In Chhattisgarh also chickpea is a very important *Rabi* crop grown under rainfed and limited irrigation conditions. It is grown in about 3.5 lakh hectare with an average productivity of one quintal per hectare. This crop is sown from second fortnight of October to first week of December. Thus the crop is exposed to different weather conditions. In Chhattisgarh, with the backdrop of climate change, chickpea area is continuously increasing in place of other *Rabi* crops like wheat, mustard and lathyrus. For assessing the suitability of chickpea to other suitable areas a knowledge of the agroclimatic requirement of chickpea is necessary.

Materials and Methods

The present study entitled "Studies on the effect of weather and irrigation on growth, development and yields of chickpea under Raipur conditions." was conducted during the Rabi season of 2013-14. The details of experimental soil, prevailing weather conditions, materials used and techniques adopted during the course of the investigation are briefly presented in this chapter.

Location of Experimental site

The field experiment was conducted at the research farm, Indira Gandhi Krishi Vishwavidyalaya; Raipur situated in South Eastern Central part of Chhattisgarh at latitude, longitude and altitude of 21016'' N, longitude 81036'' E and 289.5 m above mean sea level respectively.

Climate

The climate of Chhattisgarh state is dry sub humid. Nearly 90 % of the annual average rainfall occurs from June to September during south west monsoon. During the growth period the maximum temperature ranged between 22 ^{0}C to 36.3 ^{0}C while minimum temperature ranged between 8 to 20.7 ^{0}C. The morning relative humidity varied from 59 to 100% whereas. The afternoon humidity varied from 20 to 83 % (47 SMW and 12 SMW).

Pre-harvest observations

Dry matter accumulation

The dry matter production was recorded at 7 days interval from 30 days after sowing to harvest by selecting 5 plants each time and average dry matter production per plant was workout. This was multiplied by the plant population in each field to obtain the dry matter production per m^2.

Post-harvest observations

Number of seeds /m^2

In 10 plots of 1 m^2 each area the numbers of seeds were counted and then average values were recorded.

Grain yield (g/m^2)

The grain yield was recorded in 10 plots of 1 m^2 area and then averaged for each treatment.

Test weight (100-seed weight)

Randomly 100 seed samples were taken from each plot in each treatment.

Results and Discussion

Yield and yield attributes

The yield and other important yield attributes of chickpea under three dates of sowing in irrigated and unirrigated fields were measured and the results are discussed below:

1. Number of seeds/m^2

The number of seeds/m^2 under different dates of sowing in irrigated and unirrigated conditions for each plot is shown in Table 1. It can be seen from the table that the mean no. of seed /m^2 are very high (1210) as compare to other treatments. The difference between irrigated condition even in D_1 and D_2 is very high and that is why, there is high significance between treatments even in grain yield. The difference between D_1 unirrigated and D_2 unirrigated is relatively small and hence, the difference is not significant. In other treatments the difference is highly significant. For examining the significance of difference between different treatments 't' test was conducted. The t test results for number of seed/m^2 under different treatments it carried out and the results are under shown in next page.

Table 1: Number of seeds /m^2 of chickpea under different sowing dates in irrigated and unirrigated conditions.

Date of sowing	Irrigation	Plot no.										Mean
		1	2	3	4	5	6	7	8	9	10	
	Irrigated	1299	1216	1244	1120	1069	1213	1247	1191	1279	1229	1210.7
D_1	Un irrigated	467	619	767	508	773	489	421	622	699	384	574.9
D_2	Irrigated	721	740	698	693	802	761	647	705	645	651	706.3
	Un irrigated	491	523	563	408	498	405	442	442	540	466	477.8
D_3	Irrigated	436	498	416	465	422	391	437	483	413	481	444.2
	Un irrigated	236	277	276	216	241	277	242	287	261	277	259.0

Description	t test value
• D_1 irrigated vs D_2 irrigated.	14.78**
• D_1 unirrigated vs D_2 unirrigated.	2.72
• D_1 irrigated vs D_3 irrigated.	29.49**
• D_1 unirrigated vs D_3 unirrigated.	7.17**
• D_2 irrigated vs D_3 irrigated.	12.17**
• D_2 unirrigated vs D_3 unirrigated	12.85**

It can be seen from the above in D_1 and D_2 under unirrigated conditions the different between number of seed /m^2 is not significant. In the other words the number of seed /m^2 is more or less the same as unirrigated condition in D_1 and D_2 dates of sowing. In other treatments there is significant difference between the treatments and this is exactly the same way as in grain yield weight.

2. Grain yield

The grain yield (gm/m^2) of chickpea under different dates of sowing in irrigated and unirrigated treatments are shown in Table 2. The observations were recorded in 10 plots of 1m^2 area each and the values were averaged. It can be seen from the Table that under D_1 irrigated condition the mean value of grain weight is 353 gm/m^2 which is higher as compared to other treatments. In D_1 unirrigated condition the average grain yield was 153 gm/m^2. In D_2 field the grain yield under irrigated and unirrigated condition were 187.0 and 129.9

gm/m^2 respectively. In D_3 the grain yield was 121.1 gm/m^2 in irrigated field and it is only 53.8 gm/m^2 in unirrigated conditions. To find out the significance of results t test was conducted and the results are as shown below.

Description	t test value
• D_1 irrigated vs D_2 irrigated	18.32**
• D_1 unirrigated vs D_2 un irrigated	2.73 NS
• D_1 irrigated vs D_3 irrigated	32.27**
• D_1 unirrigated vs D_3 un irrigated	8.63**
• D_2 irrigated vs D_3 irrigated	12.29**
• D_2unirrigated vs D_3 un irrigated	16.53**

From the Table it can be observed that the difference between D_1 irrigated and D_2 irrigated is highly significant but the difference between D_1 unirrigated and D_2 unirrigated is not significance. In D_1 unirrigated and D_3 unirrigated, D_2 unirrigated and D_3 unirrigated the difference in yield is highly significant. This indicates that under unirrigated condition sowing should not be done after 30th November. Among irrigated conditions the difference between D_2 irrigated and D_3 irrigated is also highly significant. This indicates that even under irrigated condition the sowing should not be done beyond November 30.

Table 2: Grain yield (gm/m2) of chickpea under different sowing dates in irrigated and unirrigated conditions.

Date of sowing	Irrigation	Plot no.										Mean
		1	2	3	4	5	6	7	8	9	10	
	Irrigated	344.1	356.3	362.5	366.1	327.5	310.2	357.4	366.7	351.8	378.7	356.87
D_1	Un irrigated	125.9	165.7	207.4	135.8	207.6	130.3	111.1	166.5	182.6	102.5	153.5
D_2	Irrigated	191.5	198.1	188.0	183.6	204.2	202.3	171.5	187.1	170.9	172.6	187.0
	Un irrigated	131.6	141.3	152.5	110.7	135.4	111.2	120.0	123.1	146.4	126.8	477.8
D_3	Irrigated	118.8	135.5	115.7	126.4	114.4	106.8	119.3	131.3	112.8	130.6	129.9
	Un irrigated	49.5	58.1	56.0	46.0	48.8	58.0	50.7	60.8	52.9	57.0	53.8

3. Test weight

The 100 seed test weight (gm) of chickpea under different dates of sowing in irrigated and unirrigated conditions in 10 different plots was recorded and their means are shown in Table 3. It can be seen from the table that test weight was 29.3 and 27.0 gm in D_1 under irrigated and unirrigated conditions. In D_1 the test weight is 27.3 and 26.6 (gm) in irrigated and unirrigated condition respectively. In case of D_3, the test weight is 27.2 and 26.2 in irrigated and unirrigated conditions. For understanding the significance of the different in test weight t test was conducted and the results are as follows:

Description	t-test value
• D_1 irrigated vs D_2 irrigated.	4.91**
• D_1 unirrigated vs D_2 unirrigated.	1.34 NS
• D_1 irrigated vs D_3 irrigated.	7.16**
• D_1 unirrigated vs D_3 unirrigated.	19.92**
• D_2 irrigated vs D_3 irrigated.	0.63 NS
• D_2 unirrigated vs D_3 unirrigated.	16.80**

From the above it can be observed that test weight difference between D_1 and D_2 unirrigated condition and between D_2 and D_3 irrigated condition are not significant. In the other treatments it is significant. This is the reason that the grain yield under these two treatments is not significant. However, D_2 and D_3 under irrigated condition the grain yield is highly significant but the test weight is not significant. The number of seed /m^2 is highly significant between D_2 and D_3 irrigated and hence the grain yield is also highly significant between these two treatments. Similar results found to be Khatun *et al*. (2010) [3] and Thakur *et al.* (1998) [8] conducted a field trial during winter season of 1990-91 and 1991-92 at Ujjain (M.P.) with two chickpea (Cicer arietinum L.) variety 'Ujjain 21' and 'JG 315' and they observed that verity 'JG 315' gave significantly higher yield as compare to 'Ujjain 21'. This was due to improvement in yield attributing character such as pod per plants, grain per pod and test weight.

Table 3: Test weight of 100 seeds (gm.) of chickpea under different sowing dates.

Date of sowing	Irrigation	Plot no.										Mean
		1	2	3	4	5	6	7	8	9	10	
D_1	Irrigated	29.8	28.4	29.7	28.2	29.7	29.7	28.2	29.8	30.2	29.7	29.3
	Un irrigated	26.9	27.2	26.7	27.0	26.2	26.8	26.6	27.2	27.5	27.5	27.0
D_2	Irrigated	27.2	28.8	27.8	26.2	26.5	28.4	27.8	26.7	28.3	26.2	27.3
	Un irrigated	26.5	26.3	26.3	26.4	28.0	26.2	26.5	27.1	26.2	26.5	26.6
D_3	Irrigated	27.2	28.3	27.8	26.2	27.6	28.1	26.5	26.7	27.0	26.5	27.2
	Un irrigated	19.0	21.1	20.3	22.3	21.3	20.7	19.3	20.0	21.0	21.4	26.0

4. Dry matter production dynamics

The dry matter production from 30 days after sowing to harvest was studied at weekly intervals both under irrigated and unirrigated conditions in different dates of sowing and the results are shown in Table 4. It can be seen from the table and figure that the dry matter accumulation increased at faster rate in D_1 as compared to D_2 right from 10 days after sowing and continued till the maturity of the crop. However, the dry matter accumulation was lower in D_3 as compared to D_1 and D_2 in both irrigated and unirrigated sowing conditions at all the crop growth stages.

Further it was observed that the rate of increase in dry matter was slow up to 30 days after sowing and then increased rapidly between 30 to 51 days after sowing. After 50 days flowering to harvesting the rate of increase in dry matter abruptly increased in most of the irrigated conditions and this trend was continued up to maturity. The highest dry matter accumulation was observed at maturity in D_1 irrigated (777.2 gm/m^2) treatment followed by D_1 unirrigated, D_2 irrigated and unirrigated. Whereas lowest dry matter accumulation was observed in D_3 unirrigated (248.2 gm/m^2). Dry matter production reached almost plateau during maturity of the crop. Verghis *et al.* (1999) [9] and Ray *et al.* (2011) [6] study

the effect of date of sowing and irrigation regime on seed yield, yield attributes and water use of chickpea. Results revealed that Seed yield of chickpea significantly influenced by irrigation and recorded maximum of 1578.20 kg ha-1 with two irrigations at branching and pod formation stage. Two irrigations at branching and pod formation also recorded significantly higher pods planf1 (40.67), seeds per pod (2.09) and test weight (172.28). Higher AET (actual evapo-transpiration) was recorded with the increasing irrigation frequency, but water use efficiency is not proportional with irrigation level.

Table 4: Dry matter production (gm/m2) of chickpea under different sowing dates and in irrigated and unirrigated conditions.

Dates of Sowing	Irrigation	Days after sowing												
		30	37	44	51	58	65	72	79	86	93	100	107	At harvest
D_1	Irrigated	40.6	78.3	127.6	179.8	217.5	261.0	304.5	345.1	485.7	527.8	646.7	768.5	777.2
	Unirrigated	39.0	75.4	119.6	153.4	184.6	223.6	257.4	280.0	322.4	366.6	366.0	366.6	345.1
D_2	Irrigated	29.0	48.0	74.0	91.2	151.2	204.0	283.2	329.0	365.0	444.0	473.0	473.0	473.0
	Unirrigated	28.8	47.7	73.8	88.2	104	128.0	166.0	207.0	239.0	243.0	243.0	243.0	243.0
D_3	Irrigated	16.6	42.0	68.0	88.0	116.0	146.0	176.0	210.0	238.0	261.6	278.8	296.0	296.0
	Unirrigated	15.3	31.9	54.0	68.0	93.5	108.8	120.7	163.2	204.0	227.8	248.2	248.2	248.2

References

1. Anonymous. Hand book of Agriculture. Ind. Council of Agri. Res. New Delhi. 2006, 911-918.
2. FAOSTAT. Statistical Data Base of Food and Agriculture Organization, 2011.
3. Khatun A, Bhuiyan MAH, Nessa A, Hossain SMB. Effect of harvesting time on yield and attributes of chickpea (*Cicer arietinum* L.). Bangladesh J Agril. Research. 2010; 35(1):143-148.
4. Parthasarathi T, Velu G, Jeyakumar P. Impact of Crop Heat Units on Growth and Developmental Physiology of Future Crop Production: A Review. Research & Reviews: A J. of Cro. Sci. and Tech. 2013; 2(1):2319-3395.
5. Rao DLN, Giller KE, Yeo AR, Flowers TJ. The effects of salinity and sod city upon nodulation and nitrogen fixation in chickpea (*Cicer arietinum* L.). Ann. Bot. 2002; 89(5):563-570.
6. Ray M, Nanda MK, Khan DK. Effect of date of sowing and irrigation on seed yield, yield attributes and water use of Chickpea (*Cicer arietinum* L.) at lower Gangetic plains of West Bengal. J of Crop and Weed. 2011; 7(2):30-32.
7. Soltani A, Hammer GL, Torabi B. Modeling chickpea growth and development: phenological development. Field Crop Res. 2000; 99:1-13.
8. Thakur HS, Sinha NK, Raghuwanshi RKS, Sharma RA. Response of gram (*Cicer arietinum*) varieties to plant population and date of sowing. Indian. J of Agro. 1998; 43(2):315-317.
9. Verghis TI, McKenzie BA, Hill GD. Phenological development of chickpea in Canterbury. New Zealand J. of Crop and Hort. Sci. 1999; 27:249-25.