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Effect of crop residue incorporation, time of sowing and irrigation on nutrient uptake and yield of chickpea (*Cicer arietinum* L.)

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Abstract
Field experiments were conducted during *rabi* season of 2018-19 and 2019-20 at ANGRAU, Regional Agricultural Research Station, Nandyal, on vertisols with an objective to understand the impact of crop residues, time of sowing and irrigation on nutrient up take and yield of chickpea. The results indicated that, Chickpea crop grown under foxtail millet crop residue incorporated treatments recorded significantly more nitrogen, phosphorous and potassium removal through seed, haulm and total during *rabi* 2018 and *rabi* 2019, The nutrient uptake patterns showed that the first fortnight of November sown plants recorded greater nutrient uptake compared to the early (D_1) and late sown (D_4) chickpea. Similarly, increased uptake of N P and K nutrients at harvest was recorded in irrigation twice, each at pre flowering and pod development stage, followed by single irrigation at pod development stage and single irrigation at branching stage. Seed yield was higher with November 1st FN sowing with two irrigations at pre-flowering and pod development stage. however higher harvest index was recorded with November 2nd FN sowing.

Keywords: Chickpea, nutrient uptake, seed yield and harvest index

Introduction
Chickpea (*Cicer arietinum* L.) or Bengalgram is the third most important grain legume cum pulse crop in the world, whereas in India chickpea is important pulse crop placed in first position with an area of 9.55 million hectares producing 9.94 million tones with an average productivity of 1041 kg ha^{-1} (*www.indiastat.com*, 2020) [9]. The major chickpea-growing states in India are Madhya Pradesh, Uttar Pradesh, Rajasthan, Andhra Pradesh, Haryana and Maharashtra, which constitute 85 per cent area with 89 per cent production. Andhra Pradesh is one of the major chickpea producing states in India. In terms of area and production chickpea occupies 5th position, with an area of 4.78 lakh hectares producing 2.42 lakh tones with an average productivity of 508 kg ha^{-1} (*www.indiastat.com*, 2020) [9].

The chickpea area in Andhra Pradesh under double cropping system is increasing recently due to higher yields and profits within short crop growing period by exploiting residual moisture. Since very little scope exists for horizontal growth the alternative seems by achieving vertical growth through increasing its productivity level. As chickpea cultivated under residual moisture conditions, late onset of rains cause delay in sowing and harvest *of kharif* crops, ultimately delays the sowing of *rabi* chickpea under double cropping system. Delayed sowings of *rabi* chickpea leads to encounter soil moisture deficits at critical stages of crop growth and crop catches high temperatures at later stages of crop growth. These issues have to find solution to sustain yields of chickpea under double cropping system. Sustainable agricultural system is largely depends on industrial N inputs of agricultural production system. Since chickpea is leguminous crop, it can meet great portion of its nitrogen fixation, but the other nutrients P K and S should be available at sufficient levels in growth medium. Response of chickpea plants to the nutrients applied to soil vary based on available nutrient quantities in soils, climatic conditions, cultivar or genotype and some other cultural practices (Singh and Diwakar, 1995) [8].

Precise information regarding nutrient up take and yield of chickpea under crop residue incorporation, time of sowing and irrigation in vertisols is very limited. Therefore, the present study was under taken to study the impact of crop residue incorporation, time of sowing and irrigation on nutrient up take and yield of chickpea.

Material and Methods

Field experiments were carried out for two consecutive *kharif* and *rabi* seasons of 2018-19 and 2019-20 at R.A.R.S. Farm, Nandyal, Andhra Pradesh. The treatments comprised of three crop residue incorporations *viz.,* foxtail millet, (C_1) greengram(C_2) and fallow(C_3) as main plot treatments and four times of sowing *viz.* October 2nd FN (D_1), November 1st FN (D_2), November 2nd FN (D_3) and December 1st FN (D_4) as sub plot treatments and three irrigation schedules as sub- sub plots with irrigation at pre-flowering stage (I_1), irrigation at pod development stage (I_2) and irrigation at pre-flowering and pod development stage (I_3) During *kharif* season, foxtail millet and greengram crops were raised as bulk crops in respective main plots and crop residues were incorporated after harvest of economic parts *viz*., panicles of foxtail millet and pods of greengram. Experimental design was split-split plot, with three replications.

The site was situated at an altitude of 216 m above mean sea level at 15°29'19'' N latitude and 78° 29'11'' E longitude, mostly under rainfed conditions, categorized in the Scarce rainfall Agro-climatic Zone of Andhra Pradesh. The meteorological data of maximum and minimum temperature, rainfall, rainy days, morning and evening relative humidity and wind speed were recorded from meteorological observatory, Regional Agricultural Research station, Nandyal near the experimental site, during the period of crop growth. Soil of the site was medium in fertility and slightly saline in reaction having pH 8.42, electrical conductivity 0.24 dSm^{-1}, organic carbon 0.32% with available nitrogen, phosphorus and potassium of N, 143, 53 and 451 kg/ha, respectively. Sowing of seeds was done in rows, 30 cm apart with 10 cm between plants. An amount of 20 kg nitrogen and 50 kg P_2O_5 per hectare was applied through urea and single SSP in basal. Sowing was done in four intervals as D_1 on October 2nd fortnight, D_2 on November 1st fortnight, D_3 on November 2nd fortnight, D_4 on December 1st fortnight, in respective treatment plots. Healthy and matured seeds NBeG-3 chickpea desi variety having high germination percentage were used for sowing. Seed rate @ 50 kg ha^{-1} was adopted and sown in the open furrows made with the help of hand hoe. The seeds were dropped to a depth of 5 cm and covered thoroughly. The phonological development of the crop was monitored at 2- 3 days interval to decide the duration taken to reach different physiological stages, where 50% of plumule emergence was considered as days to emergence, 50% plants with one flower at any node was considered as days flowering, 95% of pods had obtained their mature colour was considered as physiological maturity and harvest stage was when all ground parts attains matured straw colour (Soltani *et al*., 2006). Profile soil moisture content was estimated for soil samples drawn at 0-15 cm and 15-30 cm depth in all chickpea treatment fields, before and after irrigation by gravimetric method.

For estimating nitrogen, phosphorus and potassium content in plants of foxtail millet, greengram and chickpea, well dried plant samples collected for dry matter production were used. Samples from each plot were oven dried, powdered and used for chemical analysis. Nitrogen content in dry matter was estimated by Microkjeldahl method (AOAC, 1960) [1]. The nitrogen uptake was calculated by multiplying the content of nitrogen with respective dry matter production and expressed in kg ha^{-1}. The di-acid digested plant samples were analysed for phosphorus content by vanado-molybdo phosphoric acid method (Jackson, 1973) [3]. The intensity of yellow colour developed was measured using spectrophotometer. The uptake of phosphorus was calculated by multiplying the phosphorus content with the respective dry matter produced and expressed as kg ha^{-1}.Potassium content of the extract of di-acid digested material was determined by using flame photometer (Jackson, 1973) [3] and uptake of potassium was estimated by multiplying the potassium content with the respective dry matter produced and presented in kg ha^{-1}.The data recorded on various parameters of crop during the course of investigation was statistically analyzed by following the analysis of variance procedure as suggested by Panse and Sukhatme (1985) [6]. Statistical significance was tested with 'F' test at 5 per cent level of probability and compared the treatment means with critical difference.

Results and Discussion

Results pertaining to effect of crop residue incorporation, time of sowing and irrigation stages on soil moisture content %, seed yield and haulm yield and water productivity were presented in table number 1 to 4 and Fig.1. Results shown yearly variations in all soil moisture % and water productivity studied.

Nutrient Uptake of Chickpea at Harvest

Nitrogen uptake

Nitrogen uptake by seed and haulm of chickpea crop at harvest was estimated for all treatments and presented in Table 1). Nitrogen uptake by seed, haulm and total was significantly influenced by crop residue incorporation, time of sowing and irrigation, during both years of study. Yearly variations were observed and higher values of nitrogen removal by seed, haulm and total uptake was recorded during *rabi* 2019 might be due to higher drymatter production with high nitrogen content. Interaction between different factors were failed to influence nitrogen uptake of chickpea crop, during both the years.

Chickpea crop grown under foxtail millet crop residue incorporated treatments recorded significantly more nitrogen removal through seed (43.8 kg ha^{-1} and 67.6 kg ha^{-1}), haulm (39.4 kg ha^{-1} and 56.1 kg ha^{-1}) and total (83.2 kg ha^{-1} and 123.7 kg ha^{-1}) during *rabi* 2018 and *rabi* 2019, respectively and on par with nitrogen uptake of chickpea crop grown under greengram crop residue incorporated treatments and both were significantly superior over fallow treatment.

Among times of sowing, November 1st FN sown chickpea recorded significantly more nitrogen uptake through seed (46.8 kg ha^{-1} and 68.7 kg ha^{-1}), haulm (43.9 kg ha^{-1} and 61.1 kg ha^{-1}) and total (90.7 kg ha^{-1} and 129.7 kg ha^{-1}) compared to rest of three times of sowing. December 1st FN sown chickpea treatment recorded lower values of nitrogen uptake in both years of study.

Irrigation twice, each at pre-flowering and pod development stage recorded significantly higher values in seed(55.4 kg ha^{-1} and 73.5 kg ha^{-1}), haulm (48.9 kg ha^{-1} and 63.1 kg ha^{-1}) and total (104.2 kg ha^{-1} and 136.5 kg ha^{-1}) nitrogen uptake of chickpea followed by irrigation at pod development stage and both were superior over irrigation at pre-flowering stage during both years of study.

Phosphorous uptake

Phosphorous uptake by seed, halm and total phosphorous uptake was significantly influenced by crop residue incorporation, time of sowing and irrigation during both years of study, but all interactions failed to differ significantly.

Yearly variations were observed and higher values of Phosphorous removal by seed, haulm and total uptake was recorded during *rabi*, 2019 (Table 2) due to higher drymatter production and better crop growth.

Chickpea crop grown after foxtail millet crop residue incorporation treatment recorded significantly more phosphorous removal through seed (3.7 kg ha^{-1} and 5.9 kg ha^{-1}), haulm (5.5 kg ha^{-1} and 8.6 kg ha^{-1}) and total (9.2 kg ha^{-1} and 14.5 kg ha^{-1}) during *rabi* 2018 and *rabi* 2019, respectively and on par with phosphorus uptake after greengram crop residue incorporated treatment and both were significantly superior over fallow treatment.

Among time of sowing, November 1st FN chickpea recorded significantly more phosphorous uptake through seed (5.3 kg ha^{-1} and 5.9 kg ha^{-1}), haulm (6.0 kg ha^{-1} and 9.0 kg ha^{-1}) and total (11.3 kg ha^{-1} and 14.9 kg ha^{-1}) compared to rest of three times of sowings. December 1st FN sowing treatment recorded lower values of nitrogen uptake in both years of study.

Irrigation twice each at pre-flowering and pod development stage (I_3) recorded significantly higher values in seed (5.1kg ha^{-1} and 6.6 kg ha^{-1}), haulm (6.9 kg ha^{-1} and 10.0 kg ha^{-1}) and total (12.0 kg ha^{-1} and 16.6 kg ha^{-1}) phosphorous uptake followed by irrigation at pod development stage (I_2) and both were superior over irrigation at pre-flowering stage (I_1) during both years of study.

Potassium uptake

Potassium uptake by seed, haulm and total potassium uptake was significantly influenced by residue incorporation, time of sowing and irrigation during both years of study, but all interactions failed to differ. Yearly variations were observed and higher values of Potassium removal by seed, haulm and total uptake was recorded during *rabi*, 2019 (Table 3).

Chickpea crop grown in foxtail millet crop residue incorporation treatment recorded significantly more potassium removal through seed

(3.5 kg ha^{-1} and 5.0 kg ha^{-1}), haulm (49.6 kg ha^{-1} and 80.7 kg ha^{-1}) and total (53.1 kg ha^{-1} and 85.7 kg ha^{-1}) during *rabi* 2018 and *rabi* 2019 respectively and on par with greengram crop residue incorporation treatment and both were significantly superior over fallow treatment.

Among time of sowing, November 1st FN chickpea recorded significantly more potassium uptake through seed, haulm and total compared to rest of three time of sowing. December 1st FN sowing treatment recorded lower values of nitrogen uptake in both years of study.

Irrigation twice at pre-flowering and pod development stage recorded significantly higher values in seed, haulm and total potassium uptake followed by irrigation at pod development stage and both were superior over irrigation at pre-flowering stage during both years of study.

The overall improvement in growth of chickpea due to rainfall and effect of applied residues could be ascribed to their pivotal role in several physiological and biochemical processes, *viz*., root development, photosynthesis, energy transformation (ATP and ADP) and symbiotic biological N_2 fixation. Significantly higher nutrient uptake with crop residue incorporation was due to higher seed and stover yield than no residue. There was poor crop growth under no residue and therefore nutrient uptake was also less in no residue treatment. 2nd time of sowing (D_2) and irrigation twice, each at branching and irrigation treatments gave higher dry matter yield and nutrient uptake of chickpea due to favourable root growth, which can able to forage more nutrients from soil. Lal and Ajit (2019) [5] observed increased NPK uptake in chickpea under zero tillage with preceding crop pearl millet crop residue incorporation.

Seed yield

Seed yield obtained were presented in Tabe.5 and pooled data indicated that foxtail millet crop residue incorporation recorded higher chickpea seed yield (1546 kg ha^{-1}) followed by greengram crop residue incorporation (1474 kg ha^{-1}). Fallow or no crop residue incorporation treatment recorded lowest seed yields (1216 kg ha^{-1}). These results are similar to that of results of Project Director, AICRP on chickpea (Anon, 2019) [2].

Possibility of supplemental irrigation twice to chickpea is better option to irrigate at pre-flowering and pod setting stage which is agreeing with findings of Satyabhan (2017) [7]. When possibility of supplemental irrigation is only for one time, it was greater advantage to give irrigation at pod development stage then pre flowering. Similar results were reported by Kirnak *et al*. (2017) [4].

Pooled analysis of seed yield also indicated significant differences in time of sowing and irrigation as that observed in individual years. The pooled yield of 1660 kg ha^{-1} was recorded with crop sown during November first fortnight (D_2) of followed by that of November second fortnight (D_3) sowing treatment. Seed yields followed increased trend up to November sowings and decreased beyond November month. The response to irrigation levels also followed similar trend as in case of individual years.

Harvest index

Harvest index of chickpea was presented in Table 5. An insight in to the data indicated that there was no significant difference due to crop residue incorporation and irrigation as well as their interactions but statistically significant values were achieved with different times of sowing.

Highest harvest index was recorded with October 2nd FN sowing, during both the years of study, which was followed by November 2nd FN, December, 1st FN and November 1st FN in order of decent. The harvest index values were in contrast to seed yields. The November 1st FN resulted in highest seed yield recorded lowest harvest index. This showed that, still there was a possibility for yield increase with best performed time of sowing, when partitioning ability was increased towards sink.

Table 1: Nitrogen uptake (kg ha^{-1}) of chickpea at harvest as influenced by crop residues incorporation, time of sowing and irrigation

Treatment	*Rabi*,2018			*Rabi*, 2019		
	Seed	Haulm	Total	Seed	Haulm	Total
Crop residue incorporation						
C_1: Foxtail millet	43.8	39.4	83.2	67.6	56.1	123.7
C_2: Greengram	41.2	36.8	78.1	66.1	63.1	129.1
C_3: Fallow	34.5	32.7	67.3	51.2	44.9	96.3
S.Em ±	0.91	0.90	1.21	1.23	1.22	6.22

CD (P = 0.05)	2.7	2.7	3.6	3.5	3.6	18.2
Time of sowing						
D_1: October 2nd FN	37.5	32.5	69.9	60.0	52.6	112.6
D_2: November 1st FN	46.8	43.9	90.7	68.7	61.1	129.7
D_3: November 2nd FN	42.4	38.6	80.9	62.6	50.0	112.6
D_4: December 1st FN	33.1	29.1	62.1	50.6	44.8	95.3
S.Em ±	0.62	0.91	0.90	1.22	0.91	3.30
CD (P = 0.05)	1.8	2.7	2.7	3.5	2.8	9.9
Time of Irrigation						
I_1: Irrigation at pre-flowering stage	29.0	24.9	53.9	51.6	44.0	95.6
I_2: Irrigation at pod development stage	35.6	31.8	67.4	57.6	51.8	109.2
I_3: Irrigation at pre-flowering and pod development stage	55.4	48.9	104.2	73.5	63.1	136.5
S.Em ±	1.22	0.92	3.20	0.63	0.91	6.23
CD (P = 0.05)	3.6	2.7	9.6	1.8	2.6	17.8
Interaction						
C × D						
S.Em ±	2.25	1.93	2.47	1.47	3.33	2.29
CD (P = 0.05)	NS	NS	NS	NS	NS	NS
C × I						
S.Em ±	3.42	2.63	1.91	0.96	1.82	1.47
CD (P = 0.05)	NS	NS	NS	NS	NS	NS
D × I						
S.Em ±	1.94	2.56	3.21	0.57	0.98	1.63
CD (P = 0.05)	NS	NS	NS	NS	NS	NS
C × D × I						
S.Em ±	2.71	3.25	6.32	1.97	1.23	2.46
CD (P = 0.05)	NS	NS	NS	NS	NS	NS

Table 2: Phosphorus uptake(kg ha^{-1}) of chickpea at harvest stage as influenced by crop residue incorporation, time of sowing and irrigation

Treatment	*Rabi*, 2018			*Rabi*, 2019		
	Seed	Haulm	Total	Seed	Haulm	Total
Crop residue incorporation						
C_1: Foxtail millet	3.7	5.5	9.2	5.9	8.6	14.5
C_2: Greengram	3.5	4.8	8.3	5.7	8.8	14.5
C_3: Fallow	3.1	4.2	7.3	4.7	6.9	11.6
S.Em ±	0.10	0.11	0.11	0.10	0.21	0.30
CD (P = 0.05)	0.3	0.3	0.3	0.3	0.6	0.9
Time of sowing						
D_1: October 2nd FN	3.2	4.8	8.1	5.4	7.6	12.9
D_2: November 1st FN	5.3	6.0	11.3	5.9	9.0	14.9
D_3: November 2nd FN	3.9	5.3	9.2	5.7	8.5	14.2
D_4: December 1st FN	3.1	4.3	7.4	4.4	6.8	11.2
S.Em ±	0.11	0.10	0.22	0.12	0.11	0.31
CD (P = 0.05)	0.3	0.3	0.6	0.3	0.3	0.9
Time of Irrigation						
I_1: Irrigation at pre-flowering stage	2.6	3.4	6.1	4.6	6.8	11.4
I_2: Irrigation at pod development stage	3.2	4.6	7.8	5.3	7.9	13.2
I_3: Irrigation at pre-flowering and pod development stage	5.1	6.9	12.0	6.6	10.0	16.6
S.Em ±	0.32	0.31	0.30	0.22	0.11	0.20
CD (P = 0.05)	0.9	0.9	0.9	0.6	0.3	0.6
Interaction						
C × D						
S.Em ±	0.63	0.95	1.63	0.65	0.63	1.25
CD (P = 0.05)	NS	NS	NS	NS	NS	NS
C × I						
S.Em ±	0.42	0.99	1.62	0.97	0.91	0.90
CD (P = 0.05)	NS	NS	NS	NS	NS	NS
D × I						
S.Em ±	0.92	1.28	2.42	1.26	0.69	2.46
CD (P = 0.05)	NS	NS	NS	NS	NS	NS
C × D × I						
S.Em ±	0.63	1.41	2.48	0.92	0.51	3.61
CD (P = 0.05)	NS	NS	NS	NS	NS	NS

Table 3: Potassium uptake (kg ha^{-1}) of chickpea at harvest stage as influenced by crop residue incorporation, time of sowing and irrigation

Treatment	*Rabi*, 2018			*Rabi*, 2019		
	Seed	Haulm	Total	Seed	Haulm	Total
Crop residue incorporation						
C_1: Foxtail millet	3.5	49.6	53.1	5.0	80.7	85.7
C_2: Greengram	3.4	46.1	49.5	5.3	79.7	85.1
C_3: Fallow	2.7	43.6	47.6	4.3	63.3	67.6
S.Em ±	0.11	0.21	0.10	0.12	1.21	1.62
CD (P = 0.05)	0.3	0.6	0.3	0.3	3.6	4.8
Time of sowing						
D_1: October 2nd FN	3.0	42.2	45.2	4.8	75.1	79.9
D_2: November 1st FN	5.3	56.6	61.9	5.5	80.4	85.9
D_3: November 2nd FN	3.5	48.9	52.4	5.5	77.5	83.1
D_4: December 1st FN	2.9	39.7	42.6	4.1	68.1	72.2
S.Em ±	0.10	1.22	0.92	0.11	1.23	1.21
CD (P = 0.05)	0.3	3.6	2.7	0.3	3.6	3.6
Time of Irrigation						
I_1: Irrigation at pre-flowering stage	2.4	35.6	38	4.3	59.2	63.5
I_2: Irrigation at pod development stage	2.8	41.8	44.6	4.4	72.4	76.8
I_3: Irrigation at pre-flowering and pod development stage	4.8	62.1	66.9	6.3	85.8	92.1
S.Em ±	0.11	1.21	2.42	0.10	2.21	2.42
CD (P = 0.05)	0.3	3.6	6.9	0.3	6.6	7.2
Interaction						
C × D						
S.Em ±	0.33	3.62	6.91	0.39	5.56	8.63
CD (P = 0.05)	NS	NS	NS	NS	NS	NS
C × I						
S.Em ±	0.94	6.21	11.29	0.96	6.31	11.54
CD (P = 0.05)	NS	NS	NS	NS	NS	NS
D × I						
S.Em ±	1.22	6.25	8.68	0.64	11.62	9.27
CD (P = 0.05)	NS	NS	NS	NS	NS	NS
C × D × I						
S.Em ±	0.52	3.99	3.90	0.41	6.24	12.32
CD (P = 0.05)	NS	NS	NS	NS	NS	NS

Table 4: Seed yield and harvest index of chickpea as influenced by crop residue incorporation, time of sowing and irrigation

Treatments	Seed yield (kg^{-1})			Harvest Index (%)		
	rabi, 2018	*rabi*, 2019	Pooled	*rabi*, 2018	*rabi*, 2019	Pooled
Crop residue incorporation						
C_1: Foxtail millet	1229	1867	1546	46.72	44.31	45.53
C_2: Greengram	1142	1828	1474	48.11	45.56	46.84
C_3: Fallow	974	1447	1216	47.03	45.67	46.37
S.Em ±	40.4	34.4	39	0.6	0.5	0.6
CD (P=0.05)	158	135	115	NS	NS	NS
Time of sowing						
D_1: October 2nd FN	1044	1700	1380	47.77	45.37	46.57
D_2: November 1st FN	1702	1957	1660	4470	43.50	44.21
D_3: November 2nd FN	1180	1770	1472	46.63	45.73	46.26
D_4: December 1st FN	935	1429	1167	47.03	44.84	45.92
S.Em ±	22.3	31.8	31	0.3	0.2	0.2
CD (P=0.05)	66	95	92	1.1	0.6	0.6
Time of Irrigation						
I_1: Irrigation at pre-flowering stage	801	1445	1117	47.55	45.04	46.31
I_2: Irrigation at pod development stage	985	1633	1300	47.11	45.10	46.10
I_3: Irrigation at pre-flowering and pod development stage	1557	2064	1819	47.14	45.41	46.29
S.Em ±	27.4	31.7	34	0.2	0.3	0.3
CD (P=0.05)	78	90	101	NS	NS	NS
Interaction						
C x D						
S.Em ±	38.5	55.2	22.5	0.6	0.6	0.9
CD (P=0.05)	115	164	96	NS	NS	NS
C x I						
S.Em ±	47.4	55.0	38.2	0.9	0.5	0.6
CD (P=0.05)	NS	NS	NS	NS	NS	NS
D x I						
S.Em ±	54.8	63.5	52.5	0.3	1.0	0.9

CD (P=0.05)	NS	NS	NS	NS	NS	NS
C x D x I						
S.Em ±	94.9	110.0	75.4	0.9	0.6	0.5
CD (P=0.05)	NS	NS	NS	NS	NS	NS

Conclusion
By two years results it was concluded that incorporation of crop residues will increase nutrient uptake of nitrogen, phosphorous and potassium by seed and haulm and increased the seed yields of chickpea. The November 1st FN resulted in highest seed yield recorded lowest harvest index.

Reference

1. AOAC. Official methods of analysis, 10th edition, Association of Official Analytical Chemist, Washington D.C 1960.
2. Anon. Project coordinators report. 2018-19. ICAR-IIPR Annual group meet on chickpea 27-29 August, 2019. Birsa Agricultural University, Ranchi. All India coordinated research project on chickpea ICAR- Indian institute of pulses research Kanpur 2019.
3. Jackson ML. *Soil Chemical Analysis*. Prentice Hall of India Pvt. Ltd. New Delhi 1973, 134-204.
4. Kirnak H, Varol IS, Irik HA, Ozaktan H. Effects of irrigation applied at different growth stages on chickpea yield. Agronomy Research 2017;15(5):1928-1933.
5. Lal PA, Ajit RS. Preceding rainy-season crops and residue management practices on growth, productivity and profitability of succeeding chickpea under zero-till semi-arid ecosystem. Acta Scientific Agriculture 2019;3(2):03-13.
6. Panse VG, Sukhatme PV. *Statistical Methods for Agricultural Workers*. Indian Council of Agricultural Research, New Delhi 1985, 100-174.
7. Satyabhan S. Effect of irrigation schedules and different levels of nutrients on Growth, yield and quality of chick pea (*Cicer arietinum* L.). Progressive Research – An International Journal Society for Scientific Development. 2017;12(1):91-95.
8. Singh, Fand Diwakar B. Chickpea botany and production practices.skill development ICRISAT Training and Fellowship programme 1995, 16.
9. www.indiastat.com 2020.