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Effect of normal and saline water irrigation on yield and yield attributes of maize cultivar district Kannauj, Uttar Pradesh

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Abstract
The field experiment was conducted during the year 2016 and 2017 at village Jasaura district Kannauj, Uttar Pradesh. Grain yield was ranged from 43.85-70.32 q ha^{-1} and 40.50-73.92 q ha^{-1}. Stover yield was ranged from 116.65-142.87 q ha^{-1} and 114.25-143.15 q ha^{-1}. Biological yield was ranged from 178.00-230.57 q ha^{-1} and 171.82-233.57 q ha^{-1}. The weight of 100 seeds was ranged from 20.88-28.40 gram and 20.75-29.78 gram. Shelling percentage was ranged from 71.15-80.22% and 70.20-80.44%. Harvest Index was ranged from 0.24-0.30% and 0.23-0.30%. Gross returns or output, net return and benefit cost ratio were ranged from Rs. 69766-107461, Rs. 3342-41037 and 0.05-0.62 and Rs. 67849-116647, Rs. (-) 1222-47576 and (-) 0.02-0.69. The highest and lowest growth and reduction on grain and stover yield was achieved from T_1-(+) 4.87% to (+) 0.19% and T_2-(-) 7.64% to (-) 2.06%. All the parameters were obtained from 2016 to 2017 year respectively.

Keywords: Longitude, latitude, benefit cost ratio, maize, GPS, harvest index, shelling percentage

Introduction
Maize (*Zea mays* L) or corn is a cereal grain belonging to the family gramineae/poaceae and is known as 'Queen of Cereals' because of its several uses. In addition to staple food for human being and quality feed for animals, maize serves as a basic raw material as an ingredient to thousands of industrial products that includes starch, oil, protein, alcoholic beverages, food sweeteners, pharmaceutical, cosmetic, film, textile, gum, package and paper industries *etc*. It is used worldwide for about 3500 products of different uses as feed (61%), food (17%) and also serves as a source of basic raw material of number of industries (22%) *viz.*, starch, ethanol, oil, alcoholic beverages, food sweeteners, pharma, cosmetics *etc.* No other cereal can be used in such many ways as maize. Every part of the maize plant has economic value the grains, leaves, stalk, tassel, and cob can all be used to produce a variety of food and non-food products. In India not only production and consumption of maize have been rising consistently, the consumption pattern has also changed over the years Kumar *et al.* (2012a) [8].

Materials and Methods
Location of study area
The field experiment was conducted in Jasaura village of Jalalabad block, Kannauj district situated in the western region of Uttar Pradesh with latitude of 270 05' North and longitude of 0790 49' East.

Survey of ground irrigation water
First of all 10 surveys were conducted within the Kannauj district. The 10 water samples were randomly collected with the help of Global Positioning System from surveyed area in labeled plastic bottle within the district. The collected water samples brought in laboratory for further desired chemical constituents examination.

Selection of study area

After chemical analysis of water samples the Jasaura village was found good and saline water. The most dominant crop in summer season was maize of this village. Therefore, Jasaura village was selected for conducted experiment purpose.

Fig 1: Map of study area

Table 1: Description of treatments combination with irrigations application.

Treatments	Irrigations pattern
T1-Normal Water (GW)	Regular
T2-Saline Water (SW)	Regular
T3-NW: SW	3 NW: 3 SW
T4-SW: NW	3SW: 3 NW
T5-NW: SW	4 NW: 2 SW
T6-SW: NW	4SW: 2 NW
T7-NW:SW	5 NW: 1 SW
T8-SW: NW	5SW: 1 NW

Table 2: Description of experimental layout

S. No.	Particulars	Descriptions
1.	Year of commencement	5 March 2016 and 5 March 2017
2.	Location	Village: Jasaura district Kannauj
3.	Recommended dose of fertilizers	150: 60:40 (N: P: K) Kg ha-1 + 20Kg ZnSO4. 7H2O + 10 tonne FYM
4.	Variety	Hybrid Maize *variety* DeKalb 9108 plus
5.	Spacing	60 x 30cm
6.	No. of irrigations-	6
7.	Design	RBD
8.	Replication:	4
9.	Plot size	2.5 x 2=5 M2
10.	Net area	160 M2

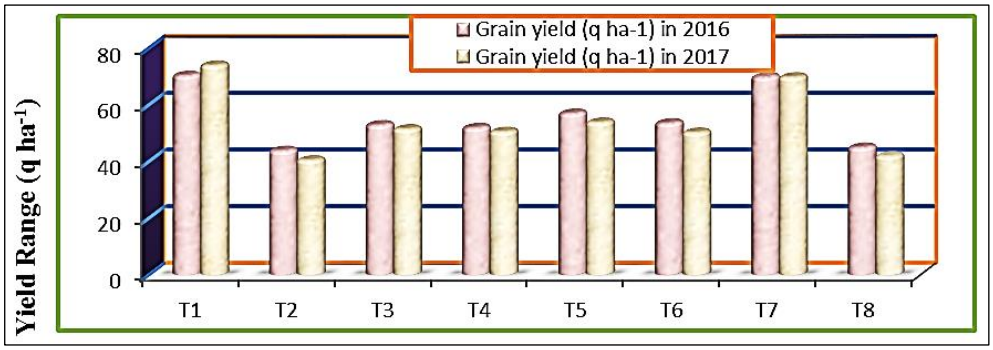
Result and Discussion

Grain yield

As depicted in Table 1.3 the maximum and minimum grain yield was found in treatment T_1-73.92q ha^{-1} and T_2-40.50q ha^{-1}. The grain yield increasing in T_1-87.45 to 91.82q ha^{-1} and reducing trends were observed in remaining treatments from previous year 2016 to final year 2017. Similar trends were observed by Aechra (2017) [1], Chaudhary, (2017) [4], Feng *et al.*, (2017) [6], Leogrande *et al.*, (2016) [9], Liu *et al.*, (2016) [10], Wang *et al.*, (2016) [12], Zhang *et al.*, (2016) [13], Awad *et al.*, (2014) [2], Faria and Mansouri (2014) [5], Azizian and Sepaskhah (2014) [3], Mojid (2013) [11].

Table 3: Grain yield (q ha^{-1}) at harvest of maize crop in 2016 and 2017

Treatments	Grain yield (q ha^{-1})	
	Mean	Mean
T_1	70.32	73.92
T_2	43.85	40.50
T_3	52.87	51.45
T_4	51.90	50.52
T_5	56.97	53.82
T_6	53.55	50.25
T_7	69.80	69.77
T_8	44.97	41.95
S. Ed (±)	1.420	1.122
C.D at 5%	4.178	3.299



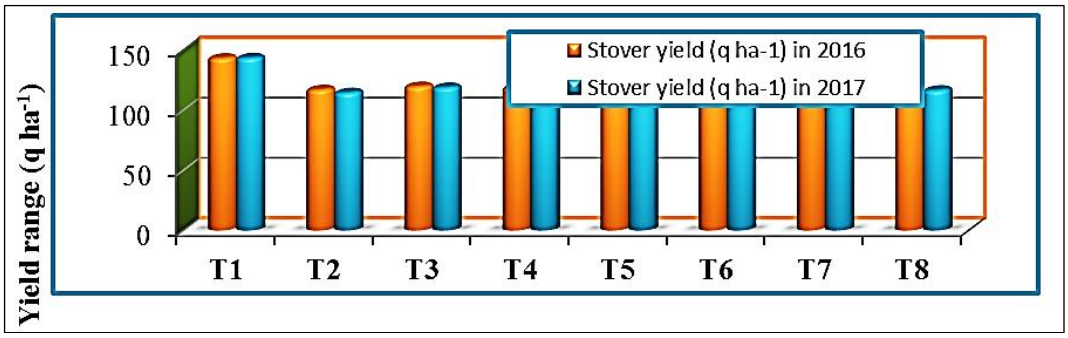
Graph 1: Grain yield (q ha^{-1}) of maize crop in 2016 and 2017

Stover yield

As depicted in Table 1.4 the maximum and minimum stover yield was found in treatment T_1-143.15 q ha^{-1} and T_2-114.25q ha^{-1}. The stover yield increasing in T_1-142.87 to 143.15 q ha^{-1} and reducing trends were observed in remaining treatments from previous year 2016 to final year 2017. Similar trends were reported by Aechra (2017) [1], Chaudhary, (2017) [4], Feng *et al.*, (2017) [6], Liu *et al.*, (2016) [10], Zhang *et al.*, (2016) [13], Awad *et al.*, (2014) [2], Mojid (2013) [11]

Table 4: Stover yield (q ha^{-1}) at harvest of maize crop in 2016 and 2017

Treatments	Stover yield (q ha^{-1})	
	Mean	Mean
T_1	142.87	143.15
T_2	116.65	114.25
T_3	119.35	118.57
T_4	118.17	118.05
T_5	120.47	120.42
T_6	118.00	117.72
T_7	142.42	140.50
T_8	116.57	116.30
S. Ed (±)	1.296	1.212
C.D at 5%	3.811	3.563



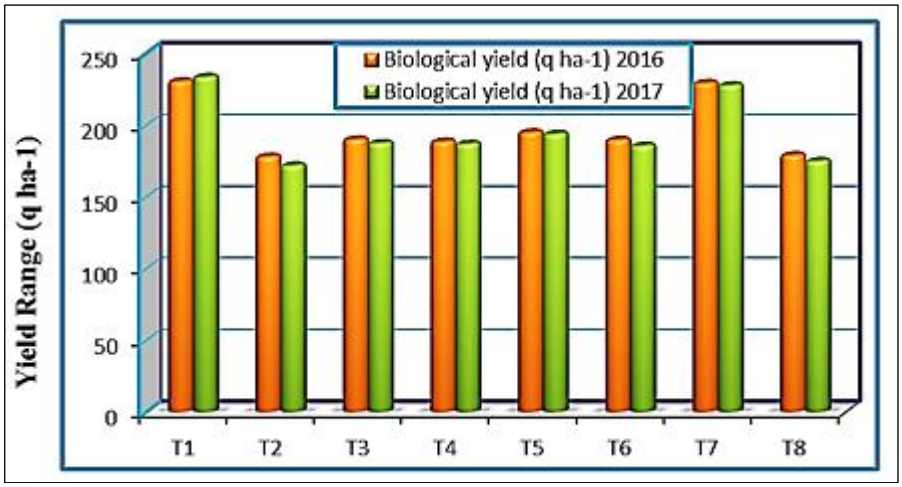
Graph 2: Stover yield (q ha^{-1}) of maize crop in 2016 and 2017

Biological Yield

As depicted in Table 1.5 the highest and lowest biological yield was found in treatment T_1-233.57 q ha^{-1} and T_2-171.82 q ha^{-1}. The biological yield increasing in T_1-230.57 to 233.57q ha^{-1} and reducing trends were observed in remaining treatments from previous year 2016 to final year 2017. Similar trends were investigated by Aechra (2017) [1], Chaudhary, (2017) [4], Feng *et al.*, (2017) [6], Liu *et al.*, (2016) [10], Zhang *et al.*, (2016) [13], Awad *et al.*, (2014) [2], Mojid (2013) [11],

Table 5: Biological yield (q ha^{-1}) at harvest of maize crop in 2016 and 2017

Treatments	Stover yield (q ha^{-1})	
	Mean	Mean
T_1	230.57	233.57
T_2	178.00	171.82
T_3	190.02	187.47
T_4	188.50	186.92
T_5	194.97	193.87
T_6	189.65	185.60
T_7	229.37	227.75
T_8	179.02	174.95
S. Ed (±)	2.170	2.063
C.D at 5%	6.383	6.066



Graph 3: Biological yield (q ha^{-1}) of maize crop in 2016 and 2017

Weight of 100 seeds

As depicted in Table 1.6 the highest and lowest weight of 100 seeds was found in treatment T_1-29.78 gram and T_2-20.75 gram. The weight of 100 seeds increasing in T_1-28.40 to 29.78 gram and reducing trends were observed in remaining treatments from previous year 2016 to final year 2017. Similar trends were examined by Aechra (2017) [1], Chaudhary, (2017) [4], Feng *et al.,* (2017) [6], Liu *et al.,* (2016) [10], Zhang *et al.,* (2016) [13], Awad *et al.,* (2014) [2], Mojid (2013) [11].

Table 6: Weight of 100 seeds (gram) of maize crop in 2016 and 2017

Treatments	Weight of 100 seeds (gram)	
	Mean	Mean
T_1	28.40	29.78
T_2	20.88	20.75
T_3	21.81	21.29
T_4	21.43	21.19
T_5	21.75	21.58
T_6	21.60	21.07
T_7	27.84	27.97
T_8	21.39	21.15
S. Ed (±)	0.265	0.226
C.D at 5%	0.780	0.664

Shelling percentage

As depicted in Table 1.7 the highest and lowest shelling percentage was found in treatment T_1-80.44% and T_2-70.20%. The shelling percentage increasing in T_1-79.98 to 80.44% and reducing trends were observed in remaining treatments from previous year 2016 to final year 2017. Similar trends were determined by Aechra (2017) [1], Chaudhary, (2017) [4], Feng *et al.,* (2017) [6], Liu *et al.,* (2016) [10], Zhang *et al.,* (2016) [13], Awad *et al.,* (2014) [2], Mojid (2013) [11].

Table 7: Shelling percentage of maize crop in 2016 and 2017

Treatments	Shelling percentage	
	Mean	Mean
T_1	79.98	80.44
T_2	71.15	70.20
T_3	74.81	74.21
T_4	73.98	73.28
T_5	76.46	74.05
T_6	74.74	74.01
T_7	80.22	80.26
T_8	71.67	71.33
S. Ed (±)	0.515	0.322
C.D at 5%	1.516	0.946

Harvest index (H.I)

As depicted in Table 1.8 the highest and lowest shelling harvest index was found in treatment T_1-0.30% T_7-0.30% and T_2-0.23% T_8-0.23% The harvest index increasing in T_1-0.29 to 0.30%, invariability in treatments T_5,T_7 and reducing trends were observed in remaining treatments from previous year 2016 to final year 2017. Similar trends were determined by Aechra (2017) [1], Chaudhary, (2017) [4], Feng *et al.,* (2017) [6], Liu *et al.,* (2016) [10], Zhang *et al.,* (2016) [13], Awad *et al.,* (2014) [2], Mojid (2013) [11].

Table 8: Harvest index of maize crop in 2016 and 2017

Treatments	Harvest index	
	Mean	Mean
T_1	0.29	0.30
T_2	0.24	0.23
T_3	0.28	0.27
T_4	0.27	0.26
T_5	0.27	0.27
T_6	0.28	0.27
T_7	0.30	0.30
T_8	0.24	0.23
S. Ed (±)	0.005	0.003
C.D at 5%	0.016	0.010

Gross returns or output

As depicted in Table 1.9 and 1.10 the highest gross return was obtained from

Table 9: Gross returns or output in 2016

Treatments	Gross return or Output (Grain @ Rs. 1325 and Stover @ Rs. 100 per quintal)				
	Grain yield (q ha^{-1})	Sale Cos (Rs.1225)	Stover yield (q ha^{-1})	Sale Cost (Rs.100)	Gross Return (Rs.0.0)
T_1	70.32	93174	142.87	14287	107461
T_2	43.85	58101	116.65	11665	69766
T_3	52.87	70053	119.35	11935	81988
T_4	51.90	68767	118.17	11817	80584
T_5	56.97	75485	120.47	12047	87532
T_6	53.55	70954	118.00	11800	82754
T_7	69.80	92485	142.42	14242	106727
T_8	44.97	59585	116.57	11657	71242

Table 10: Gross returns or output in 2017

Treatments	Gross return or Output (Grain @ Rs. 1325 and Stover @ Rs. 100 per quintal)				
	Grain yield (q ha^{-1})	Sale Cost (Rs.1225)	Stover yield (q ha^{-1})	Sale Cost (Rs.100)	Gross Return (Rs.0.0)
T_1	73.92	100901	143.15	15746	116647
T_2	40.50	55282	114.25	12567	67849
T_3	51.45	70229	118.57	13043	83272
T_4	50.52	68960	118.05	12985	81945
T_5	53.82	73464	120.42	13246	86710
T_6	50.25	68591	117.72	12949	81540
T_7	69.77	95236	140.95	15504	110740
T_8	41.95	57262	116.30	12793	70055

Treatment T_1 followed by T_7, T_5, T_3, T_4, T_6, T_8, T_2 in previous year 2016 and second year 2017 respectively. The gross return was increased from previous to final year except treatments T_2, T_5, T_6 and T_8 in these treatments gross return was decreased. The lowest gross return was achieved from treatment T_2 in previous year whereas; negatively gross return was obtained during second year from treatment T_2. Similar trends were observed by Faria and Mansouri (2014) [5].

Input, net return and benefit cost ratio

As depicted in Table 1.11 and 1.12 the input was change Rs. 66424=00 to 69071 from previous year to final year due to increasing cost of input components. The highest net return and B.C Ratio were achieved from treatment T_1 followed by T_7, T_5, T_3, T_4,T_6, T_8, T_2 in previous year 2016 and final year 2017 respectively.

Table 11: Input, gross return, net return and benefit cost ratio in 2016

Treatments	Input (Rs.)	Gross return (Rs.)	Net return (Rs.)	B.C Ratio
T_1	66424	107461	(+) 41037	(+) 0.62
T_2	66424	69766	(+) 3342	(+) 0.05
T_3	66424	81988	(+) 15564	(+) 0.23
T_4	66424	80584	(+) 14160	(+) 0.21
T_5	66424	87532	(+) 21108	(+) 0.32
T_6	66424	82754	(+) 16330	(+) 0.24
T_7	66424	106727	(+) 40303	(+) 0.61
T_8	66424	71242	(+) 4818	(+) 0.07

Table 12: Input, Gross return, Net return and Benefit Cost Ratio in 2017

Treatments	Input (Rs.)	Gross return (Rs.)	Net return (Rs.)	B.C Ratio
T_1	69071	116647	(+) 47576	(+) 0.69
T_2	69071	67849	(-) 1222	(-) 0.02
T_3	69071	83272	(+) 14201	(+) 0.20
T_4	69071	81945	(+) 12874	(+) 0.19
T_5	69071	86710	(+) 17639	(+) 0.25
T_6	69071	81540	(+) 12469	(+) 0.18
T_7	69071	110740	(+) 41669	(+) 0.60
T_8	69071	70055	(+) 984	(+) 0.01

The lowest net return and B.C Ratio were achieved from treatment T_2 in previous year whereas; negatively net return and B.C Ratio were obtained during second year from treatment T_2. Similar trends were reported by Faria and Mansouri (2014) [5].

Growth and reduction on grain and Stover yield

As depicted in Table 1.13 the highest and lowest growth and reduction on grain and Stover yield was received from T_1-(+) 4.87% to (+) 0.19% and T_2-(-) 7.64% to (-) 2.06% from previous year 2016 to final year 2017 respectively. The stability was not found in any treatments previous to final year. Similar trends were observed by Azizian and Sepaskhah (2014) [3].

Table 13: Growth and reduction on grain and stover yield from 2016 to 2017

Treatments	Grain yield (q ha^{-1}) 2016	Grain yield (q ha^{-1}) 2017	% age growth and reduction	Stover yield (q ha^{-1}) 2016	Stover yield (q ha^{-1}) 2017	% age growth and reduction
T_1	70.32	73.92	(+) 4.87	142.87	143.15	(+) 0.19
T_2	43.85	40.50	(-) 7.64	116.65	114.25	(-) 2.06
T_3	52.87	51.45	(-) 2.68	119.35	118.57	(-) 0.65
T_4	51.90	50.52	(-) 2.66	118.17	118.05	(-) 0.10
T_5	56.97	53.82	(-) 5.53	120.47	120.42	(-) 0.04
T_6	53.55	50.25	(-) 6.16	118.00	117.72	(-) 0.24
T_7	69.80	69.77	(-) 0.04	142.42	140.95	(-) 1.03
T_8	44.97	41.95	(-) 6.71	116.57	116.30	(-) 0.23

Conclusion

Among the various studies was found that treatment first superior over all treatments. When number of saline irrigation water increasing and normal water irrigation applied in decreasing manner maize growth and yield was found reduced and physico-chemical properties of soil were going increasing order. The soil application of gypsum and phospho-gypsum will be best amendments for management practices to sustain productivity and avoid soil from degradation losses.

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