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Influence of Irrigation Systems and Planting Dates on Tubers Weight of different Grade Yield of Potato (*Solanum tuberosum* L.)

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ABSTRACT: Among different irrigation systems, micro-sprinkler irrigation (I_2) was significantly enhance tubers weight of different grade yield of Potato acre[1] i.e. >25-50 g (7.81 & 7.53q), >50-75 g (16.43q), >75 g (77.02 & 91.58 q) and Total tuber yield (*q/ha*) (24.11 & 27.07q) Harvested at 75 DAP and 90 DAP, respectively, of potato over furrow irrigation, except grade >25 g (2.75 & 2.59 q) at 75 DAP and 90 DAP and >50-75 g (10.35 q) 90 DAP in which furrow irrigation (I_1) was significantly enhance tubers weight of potato over micro-sprinkler irrigation (I_2). whereas, among dates of different of sowing, 15th October (D4) had significant effects on potato different grade yield of Potato (*q/acre) i.e.* >25 g (3.36 and 2.83q), >25-50 g (8.66 and 8.34q), >50-75 g (19.58 and 1.42q), >75 g (111.13 & 140.02 q) Harvested at 75 DAP and 90 DAP, respectively, Harvested at 75 DAP and 90 DAP), and Total tuber yield (*q/ha*) (35.26 & 40.43q) harvested at 75 DAP and 90 DAP over rest of the other planting dates during 2017-18 to 2018-19. All tubers weight of different grade of potato crop variety (Kufri Lima) sown on 15 October and harvested at 75 DAP and 90 DAP by micro-sprinkler irrigation system performed best under Hisar conditions.

Keywords: Dates of planting, different grade yield, furrow, micro-sprinkler, potato.

INTRODUCTION

Potato (*Solanum tuberosum* L.) is a native of the South American continent, where it grew as a wild plant between 7000 and 9000 years ago. In the 17th century, all the credit for bringing potatoes to India goes to Purtigalio, after which the British carried it to North India. It is considered to be the only popular tuber grown in more than 100 natives all over the world (Nath *et al.*, 2008; Pandey and Sarkar 2005; Touseef, 2016). Potato is the most popular non-cereal crop all over the world, along with it is also the fourth most important food crop (Zhang *et al*., 2017; Anonymous, 2017). Potato was documented as a safe food and crop for the world's poor as well as developing countries by Thiele *et al.* (2010); Singh and Rana (2013).

Presently, India is behind only China in potato production in the whole world. In 2017-18, India produced 525.89 lakh tonnes of potato on 21.84 million hectares, with a productivity of 24.08 t ha^{-1} (Anonymous, 2019). Potato is grown in almost all the states in India, yet seven of them (Uttar Pradesh, West Bengal, Bihar, Gujarat, Madhya Pradesh, Punjab and Haryana) have 90% potato production (Anonymous, 2018). Haryana is one of the main potato producing states in India, whose productivity is more than the average productivity of India, along with potato is also one of the main crops here. Potato has the highest area among the crops grown in the state. The area, production and productivity of potato in Haryana has not improved as much as it should have, the area under potato crop during the year 2018-19 was 34738 hectare, production 8977846 tonne hectare and productivity 25 t/ha (Anonymous, 2020).

Potatoes are also rich in nutrients, which mainly contain vitamin C, potassium as well as dietary fiber (Weaver and Marr 2013). If the nutrient value ratio of potato is compared with all other vegetables and fruits, then in this case it proves to be very economical, so it is included in the most economical nutritional food in the whole world (Drewnowski and Rhem 2013). Animal and human research indicates that the nutrients in potatoes may positively affect a number of disease risk factors, including chronic disease, including blood pressure, blood lipids, and inflammation (Beals, 2019).

Soil temperature plays an important role in potato maturation, for example, 16-19°C temperature is important for tuber sprouting and initial growth,

temperatures above 20°C reduce tuber development and if the temperature exceeds 30 °C, then the growth of the tuber stops. More tubers are obtained from one plant if the temperature is low rather than high whereas at higher temperature the size of potato increases and the number decreases (Pandey *et al.*, 2008). In North and Central India, the temperature is favorable for sowing of potatoes after mid-October, only then potatoes are sown at the same time because if sowing is done early, then early planting can result in rotting of tubers in the post monsoon season. For balanced growth of tubers, it is necessary to have optimum level of moisture in the roots zone of the plant, which can be achieved by modern irrigation methods like drip and sprinkler (Pawar *et al.*, 2002).

Furthermore, sprinkler irrigation technologies allow for more efficient resource utilization and increased agricultural output (Singh *et al.*, 2001). The main reasons for increasing productive capacity of tuber crop with micro-sprinklers can be attributed to mitigation of effect of white fly, nutrient leaching and soil moisture fluctuations in effective root zone. When comparing drip and furrow watered crops to micro-sprinkler irrigated crops, it was clearly seen that whitefly infestation was less severe. The leaf canopy was cleansed and the whitefly infestation was controlled by frequent irrigation with a micro-sprinkler. Aside from that, micro-sprinkler irrigation may have provided a better microclimate, allowing for enhanced photosynthesis, root aeration, and plant growth, resulting in increased yields (Holzapfel *et al.*, 2000).

MATERIALS AND METHODS

DURING the winter (Rabi) seasons of 2017-19, the research work, entitled "Influence of Irrigation Systems and Planting Dates on tubers weight of different grade yield of Potato (*Solanum tuberosum* L.) was carried out at the Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar.

The following are the details of the materials and methods used in this study:

A. Location of the experiment, climate, and meteorological circumstances

Hisar is located at latitude of 29º10′N, longitude of 75º 46′E and at the elevation of 215.2 m above mean sea level and falls in semi-arid and sub-tropical region with hot and dry summer and severe cold in winters. Monthly mean meteorological data (maximum and minimum temperature, relative humidity, sunshine, and rainfall) collected by the Department of Agricultural Meteorology, CCS HAU, Hisar, during the crop Growing season 2017-19.

B. Soil characteristics

The composite soil samples were gathered from the experimental field up to a depth of 15 cm before the experiment. Before applying treatments, these samples were analyzed to determine the original state of the soil. The physico-chemical properties of the samples were investigated.

C. Experimental details

The research was completed at Research Farm of the Department of Vegetable Science, Chaudhary Charan Singh Haryana Agricultural University, Hisar during *Rabi* season of 2017-19. Two experiments were conducted during the research, the other details of the experimental material, design and treatments are given as under:

Experiment 1: Influence of Irrigation Systems and Planting Dates on tubers weight of different grade yield of Potato harvested at 75 days after planting.

Experiment 2: Influence of Irrigation Systems and Dates of Planting on tubers weight of different grade Potato yield harvested at 90 days after planting.

Design of Experimental-Split plot design, Variety of potato-Kufri Lima, Replications Numbers-4, Net plot size (m^2) 3×2 m (6 m^2), Spacing between rows-60 cm and Plant-to-plant distance-20 cm.

Experiment design and layout. Split-plot Design (SPD) was used to set up the experiment, which was then reproduced four times. With the use of a random number table, the 8 treatments were randomized.

Experimental materials. The Department of Vegetable Science, CCS Haryana Agricultural University, Hisar (Haryana) provided the seed tubers of potato variety Kufri Lima used in this study. Following are the specifics of the treatment:

Main plot. Irrigation methods - 2

— I_1: Furrow irrigation (30 mm CPE)

— I_2: Micro-sprinkler (10 mm CPE)

Sub-plot. Planting dates - 4

1st September, 15th September, 30th September and 15th October

Sr. No.	Notation	Description
1.	$D_1 I_1$	Planted on September 1st with furrow irrigation system
2.	$D_2 I_1$	Planted on September 15th with furrow irrigation system
3.	$D_3 I_1$	Planted on September 30th with furrow irrigation system
4.	$D_4 I_1$	Planted on October 15th with irrigation system
5.	$D_1 I_2$	Planted on September 1st with micro-sprinkler irrigation system
6.	$D_2 I_2$	Planted on September 15th with micro-sprinkler irrigation system d
7.	$D_3 I_2$	Planted on September 30th with micro-sprinkler irrigation system
8.	$D_4 I_2$	Planted on October 15th with micro-sprinkler irrigation system

D. Cultural operations

The cultural operations practiced in the course of experiment are described below:

(i) **Field preparation and application of fertilizer.** During both years, the experimental field was appropriately prepared in the last week of August. To smash clods, the field was ploughed twice using a tractor-drawn cultivator after the previous crop was harvested. The field was ploughed by cross harrowing followed by the cultivator twice and in the final planking to bring the soil to a fine tilth before sowing.

(ii) **Seed rate and sowing.** In the 1st September, 15th September, 30th September, and 15th October in 2017 and 2018, a potato planter planted seeds of the potato crop @ 30 q/ha on a well-prepared field

E. Details of collection of experimental data

The following are the details of the different observations made, as well as the procedures to be used:

(i) **Weight of tubers in different grades (kg/m^2) i. >25 g, ii. >25-50 g, iii. >50-75 g and iv. >75 g.** At the time of harvest, the potato tubers from each treatment which were divided into four grades for number of tubers such as A grade (>75g), B grade (>50-75g), C grade (>25-50g) and D grade (up to 25g) were weighed separately and computed for the weight of tuber in different grade in kilogram in one square meter and convert into Q/Acre.

$$\text{Weight of tubers in different grade (kg/m}^2\text{)} = \frac{\text{Weight of different grades of tubers per plot}}{\text{Plot size}}$$

(ii) **Total tuber yield (Q/Ha).** At the time of harvest, the potato tubers from each net plot, which were divided into four grades such as, up to 25 g (D grade), >25-50 g (C grade), >50-75 g (B grade) and >75 g (A grade), were weighed separately and computed for the weight of tubers in different grades in kilogram in one square meter area. The total yield was obtained by summing up the weight of A, B, C and D grade tubers of each net plot as taken for weight of tubers of different grades. Then the values were converted into kilogram per square meter and convert into Q/Ha.

F. Statistical analysis

The data collected for each character during the study was statistically evaluated using the analysis of variance technique (ANOVA). The significant difference (CD) was calculated using the following method to determine the significance of the difference between the mean of two treatments:

$$CD = \sqrt{\frac{2 \times \text{Mean square error}}{n}} \times 't' \qquad (1)$$

Where, CD = Critical difference

n = Number of replications of the factor for which C.D. is to be calculated.

t = the value from fisher table for error degree of freedom at 5% level of significance.

RESULTS

A. Weight of tubers in different grade up to 25 g (Q/Acre)

The data mentioned in Table 1 shows that highest weight of tuber per m^2 in grade up to 25 g at harvest (2.75 & 2.59 q at 75 DAP and 90 DAP, respectively during 2017-19) were observed with furrow irrigation system (I_1) than micro-sprinkler irrigation method (I_2). Among different dates of planting, highest weight of tuber per m^2 in grade, up to 25 g at harvest (3.36 & 2.83 q at 75 DAP and 90 DAP. Respectively, during 2017-19,) were observed in potato planted on 15th October (D_4). While evaluating the combinations of various planting dates with different systems of irrigation highest weight of tuber per acre in grade up to 25 g at harvest (3.60 & 3.84 q harvested at 75 DAP and 90 DAP, respectively, during 2017-19) were observed in treatment D_4I_1 (Potatoes were planted on the 15th of October with furrow irrigation) which were not affected significantly by different combination.

Table 1: Influence of irrigation systems and planting dates on tubers weight upto 25g of potato (Q/Acre).

Irrigation methods / Planting dates	Harvested at 75 DAP 2017–19 (Pooled)			Harvested at 90 DAP 2017–19 (Pooled)		
	Furrow (I_1)	Micro-sprinkler (I_2)	Mean	Furrow (I_1)	Micro-sprinkler (I_2)	Mean
1st September (D_1)	1.62	1.41	1.54	1.74	1.25	1.50
15th September (D_2)	2.43	2.22	2.35	2.47	1.82	2.14
30th September (D_3)	3.36	2.59	2.95	2.87	2.06	2.47
15th October (D_4)	3.60	3.07	3.36	3.84	2.43	2.83
Mean	2.75	2.34		2.59	1.90	
CD at significance level 5%	Irrigation (I) : 0.20 Planting Date (D) : 0.44 Factor (D) at same level of (I) : N/A Factor (I) at same level of (D) : N/A			Irrigation (I) : 0.36 Planting Date (D) : 0.53 Factor D at same level of (I) : N/A Factor I at same level of (D) : N/A		

Lowest weight of tuber per area in grade up to 25 g of potato at harvest were recorded in treatment D_1I_1 (Potatoes were planted on the 1st of October with furrow irrigation) followed by D_1I_2 (Potatoes were planted on the 1st of September with micro-sprinkler irrigation).

B. Weight of tubers in different grade >25-50 g (Q/Acre)

The data mentioned in Table 2 indicates that highest weight of tuber per acre in grade up to 25 g at harvest (7.81 & 7.53 q at 75 DAP and 90 DAP, respectively during 2017-19) were recorded under furrow irrigation System (I_1) than micro-sprinkler irrigation method (I_2). Among different dates of planting, highest weight of tuber per acre in grade, up to 25 g at harvest (8.66 & 7.53q at 75 DAP and 90 DAP respectively during 2017-19) were recorded in potato planted on 15th October (D_4). When evaluating the combinations of different planting dates with different system of irrigation highest weight of tuber per acre in grade up to 25 g at harvest (9.35 and 9.67q harvested at 75 DAP and 90 DAP during 2017-19, respectively) were observed in treatment D_4I_1 (On the 15th of October, potatoes were planted under furrow irrigation) which were not affected significantly by different combination. Lowest weight of tuber/acre in grade up to 25 g of potato at harvest were recorded in treatment D_1I_1 (where potatoes were planted via furrow irrigation on September 1st) followed by D_1I_2 (where potatoes were planted on September 1st and irrigated with a micro-sprinkler).

Table 2: Impact of irrigation systems and planting dates on tubers weight in grade 25-50g of potato (Q/Acre).

Irrigation methods / Planting dates	Harvested at 75 DAP 2017–19 (Pooled)			Harvested at 90 DAP 2017–19 (Pooled)		
	Furrow (I_1)	Micro-sprinkler (I_2)	Mean	Furrow (I_1)	Micro-sprinkler (I_2)	Mean
1st September (D_1)	3.16	5.01	4.03	3.84	4.45	4.17
15th September (D_2)	6.47	8.01	7.24	5.99	7.48	6.72
30th September (D_3)	6.88	8.82	7.85	6.80	8.54	7.65
15th October (D_4)	7.77	9.35	8.66	7.00	9.67	8.34
Mean	6.11	7.81		5.91	7.53	
CD at significance level 5%	Irrigation (I) : 0.44 Planting Date (D) : 0.56 Factor (D) at same level of (I) : N/A Factor (I) at same level of (D) : N/A			Irrigation (I) : 0.81 Planting Date (D) : 0.73 Factor (D) at same level of (I) : N/A Factor (I) at same level of (D) : N/A		

C. Weight of tubers in different grade >50-75(Q/Acre)

The data mentioned in Table 3 shows that the highest weight of tuber/acre in grade > 50-75 g at harvest, i.e. 16.43q at 75 DAP during 2017-19, were observed with micro-sprinkler irrigation method (I_2) and 10.35 q kg at 90 DAP during 2017-19, were recorded under furrow irrigation method (I_1). Among different planting dates, highest weight of tuber/acre in grade > 50-75 g at harvest (19.85 & 12.42 q at 75 DAP and 90 DAP, respectively during 2017-19) were observed in potato planted on 15th October (D_4). While comparing the combinations of different dates of planting with different methods of irrigation, significantly highest weight of tuber/acre in grade > 50-75 g at highest weight i.e. 20.75q at 75 DAP during 2017-19, were recorded in treatment D_4I_2 (On the 15th of October, potatoes were planted under micro-sprinkler irrigation) and 10.35 kg at 90 DAP during 2017-19, were recorded in treatment D_4I_1 (On the 15th of October, potato was planted under micro-sprinkler irrigation) which were affected significantly by different combination. The low weight of tuber/acre in grade > 50-75 g of potato at harvest were recorded in treatment D_1I_1 (where potatoes were planted via furrow irrigation on September 1st) followed by $D_1 I_2$ (where potatoes were planted on September 1st and irrigated with micro-sprinkler).

Table 3: Impact of irrigation systems and planting dates on tubers weight in grade 50-75g of potato (Q/Acre).

Irrigation methods / Planting dates	Harvested at 75 DAP 2017–19 (Pooled)			Harvested at 90 DAP 2017–19 (Pooled)		
	Furrow (I_1)	Micro-sprinkler (I_2)	Mean	Furrow (I_1)	Micro-sprinkler (I_2)	Mean
1st September (D_1)	5.91	7.93	6.92	7.48	4.00	5.74
15th September (D_2)	12.30	17.20	14.73	9.14	8.09	8.62
30th September (D_3)	15.74	19.82	17.76	11.73	10.24	10.96
15th October (D_4)	18.45	20.76	19.58	13.07	11.77	12.42
Mean	13.11	16.43		10.35	8.54	
CD at significance level 5%	Irrigation (I) : 0.93 Planting Date (D) :0.97 Factor (D) at same level of (I) : 1.53 Factor (I) at same level of (D) : 1.50			Irrigation (I) : 0.44 Planting Date (D) : 0.61 Factor (D) at same level of (I) : 0.89 Factor (I) at same level of (D) : 0.81		

D. Weight of tubers in different grade >75(Q/Acre)

The data mentioned in Table 4 reveals that significantly highest weight of tuber/acre in grade > 75g at harvest (77.02q & 91.58 at 75 DAP and 90 DAP, respectively during 2017-19) were recorded under micro-sprinkler irrigation method (I_2) over furrow irrigation method (I_1). Among different dates of planting, significantly highest weight of tuber/acre in grade >75 g at harvest (111.13q at 75 DAP & 140.02q harvested at 90 DAP, respectively during 2017-19) were recorded in potato planted on 15th October (D_4) over rest of the other date of planting. While comparing the combinations of different dates of planting with different methods of irrigation, highest weight of tuber/acre in grade >75 kg at harvest (112.66q at 75 DAP & 143.66 at 90 DAP during 2017-19) were recorded in treatment D_4I_2 (On the 15th of October, potatoes were planted under micro-sprinkler irrigation) which was statistically at par with D_4I_1 (109.59) at same level of date of planting at 75 DAP during 2017-19. Lowest weight of tuber/acre in grade >75 g of potato at harvest were recorded in treatment D_1I_1 (where potato planted on1st September under furrow irrigation) followed by D_1I_2 (where potato planted on 1st September under micro-sprinkler irrigation).

Table 4: Impact of irrigation systems and planting dates on tubers weight in grade >75g of potato (Q/Acre).

Irrigation methods / Planting dates	Harvested at 75 DAP 2017-19 (Pooled)			Harvested at 90 DAP 2017–19 (Pooled)		
	Furrow (I_1)	Micro-sprinkler (I_2)	Mean	Furrow (I_1)	Micro-sprinkler (I_2)	Mean
1st September (D_1)	10.12	19.62	14.89	12.99	24.88	18.93
15th September (D_2)	30.75	56.25	43.50	49.169	80.13	64.67
30th September (D_3)	88.14	95.46	91.37	107.89	117.60	112.74
15th October (D_4)	109.59	112.66	111.13	136.37	143.66	140.02
Mean	59.49	77.02		76.61	91.58	
CD at significance level 5%	Irrigation (I) :3.56 Planting Date (D) : 4.16 Factor (D) at same level of (I) : 6.47 Factor (I) at same level of (D) : 6.15			Irrigation (I) : 6.80 Planting Date (D) : 7.97 Factor D at same level of (I) : 6.92 Factor I at same level of (D) : 8.13		

In the present study, significantly higher number of tubers of grade up to 25g in potato (ranged from 13.94 to 18.44% harvested at 75 DAP and 6.99 to 34.95% harvested at 90 DAP) was observed under furrow irrigation method over micro-sprinkler irrigation during 2017-18 and 2018-19, respectively. Similar finding of higher number of smaller grade of potato under furrow irrigation method over micro-sprinkler irrigation method was observed by Patel *et al.*, (2011) whereas, significantly higher number of tubers of grade up to 25g in potato (30.54 to 20.12% harvested at 75 DAP and 13.05 to 18.38% harvested at 90 DAP) was observed in potato planted on 15th October over one month early potato planted on 15th September during 2018-19 and 2017-18, respectively.

E. Total tuber yield (Q/Ha)

The data mentioned in Table 5 reveals that significantly highest total tuber yield (24.11 q/ha at 75 DAP & 246.1 and 27.07 Q/Ha at 90 DAP during 2017-19, respectively) were recorded under micro-sprinkler irrigation method (I_2) over furrow irrigation method (I_1). Among different dates of planting, significantly highest total tuber yield (35.26 Q/Ha at 75 DAP & 40.43 Q/Ha at 90 DAP during 2017-19, respectively) were recorded in potato planted on 15th October (D_4) over rest of the other date of planting.

Table 5: Effect of irrigation methods and planting dates on total weight of tubers in potato (q/ha).

Irrigation methods / Planting dates	Harvested at 75 DAP 2017–19 (Pooled)			Harvested at 90 DAP 2017–19 (Pooled)		
	Furrow (I_1)	Micro-sprinkler (I_2)	Mean	Furrow (I_1)	Micro-sprinkler (I_2)	Mean
1st September (D_1)	51.40	84.30	67.80	64.40	85.50	74.90
15th September (D_2)	128.40	206.70	167.50	165.00	241.00	203.00
30th September (D_3)	281.90	313.10	297.50	319.50	342.10	330.80
15th October (D_4)	344.90	360.40	352.60	394.50	414.00	404.30
Mean	201.60	241.10		235.80	270.70	
CD at 5% level of significance	Irrigation (I) : 10.60 Date of planting (D) : 12.00 D at same level of I : 18.80 I at same level of D : 17.90			Irrigation (I) : 16.80 Date of planting (D) : 09.90 D at same level of I : 17.40 I at same level of D : 20.20		

While comparing the combinations of different dates of planting with different methods of irrigation, highest total tuber yield (36.04 Q/Ha at 75 DAP & 41.40 Q/Ha at 90 DAP during 2017–19, respectively) were recorded in treatment D_4I_2 (On the 15th of October, potato was planted under micro-sprinkler irrigation). Lowest total tuber yield of potato were recorded in treatment D_1I_1 (where potatoes were planted via furrow irrigation on September 1st) followed by D_1I_2 (where potatoes were planted on September 1st and irrigated with a micro-sprinkler).

DISCUSSIONS

A. Weight of tubers of different grades

In the present study, significantly higher weight of tubers of grade up to 25g in potato (ranged from 17.09% harvested at 75 DAP and 36.31% harvested at 90 DAP) was observed under furrow irrigation method over micro-sprinkler irrigation during 2017-19. Similar finding of increased in weight of smaller grade of potato under furrow irrigation method over micro-sprinkler irrigation method was observed by Patel *et al.*, (2011) whereas, significantly higher weight of tubers of grade up to 25g in potato (42.97% harvested at 75 DAP and 32.24 harvested at 90 DAP) was observed in potato planted on 15th October over one month early potato planted on 15th September during 2018-19, respectively. Contrary trend of reduction in weight of smaller grade of tubers in timely planted potato was observed by Singh *et al.,* (2018).

On the other hand, a trend of increased in weight of tubers q $acre^{-1}$ of grade >25-50 g of potato (27.65% harvested at 75 DAP and 27.41% harvested at 90 DAP); of grade >50-75g of potato (25.32% harvested at 75 DAP) and grade >75g of potato (29.46% harvested at 75 DAP and 19.54% harvested at 90 DAP) was observed under micro-sprinkler irrigation method over furrow irrigation method during 2017-19, respectively. It may be due to uniform availability of water under micro-sprinkler irrigation method that increased the weight of bigger tubers. Similar finding of higher weight of bigger grade of potato in micro-sprinkler irrigation method over furrow irrigation method was observed by Patel *et al.,* (2011). Likewise, Similar trend of increased in weight of tubers $acre^2$ of grade >25-50g of potato (19.61% harvested at 75 DAP and 24.10% harvested at 90 DAP); of grade >50-75g of potato (32.92% harvested at 75 DAP and 44.08% harvested at 90 DAP) and of grade >75g of potato (67.63% harvested at 75 DAP and 116.51% harvested at 90) was observed in potato planted on 15th October over one month early potato planted on 15th September during 2017-19. It may be due to the optimization of temperature favorable to increase the weight of bigger tubers of potato at timely sown condition in comparison to warmer temperature at one month early planted crop of potato.

B. Total tuber yield (Q/Ha)

Total weight of tubers (Q/Ha) of potato was affected significantly by method of irrigation. Significantly, higher total weight of tubers per ha (19.54% harvested at 75 DAP and 14.80% harvested at 90 DAP) was observed under micro-sprinkler irrigation method over furrow irrigation during 2017-19. Higher tuber yield under sprinkler irrigation could be attributed to optimum soil moisture throughout the period of crop growth, which resulted in manipulation of soil temperature and helped in better root growth and tuber development. The present results are in conformity with the findings of Singh and Sood, (2013) and Mustafa *et al.,* (2017) found more total yield of tubers/ha of potato through sprinkler irrigation as compared to furrow irrigation whereas, significantly higher total weight of tubers per ha (110.50% harvested at 75 DAP and 99.16% harvested at 90 DAP) was observed in potato planted on 15th October over one month early potato planted on 15th September during 2017--19. Similar trend of increased in total weight of tubers per m^2 in timely planted potato was observed by Haile *et al*., (2015) and Thongam *et al*., (2017). It may be due to the optimization of temperature favorable to increase total weight of tubers at timely sown condition in comparison to warmer temperature at one month early planted crop of potato.

CONCLUSION

Based on the findings of this study, Micro-sprinkler irrigation with Kufri-Lima found superior to increase weight of the tubers from 14 to 110.50% significantly more were harvested at 75 DAP and 90 DAP, respectively, which was comparatively higher than furrow irrigation method. Finally, by following the conclusion, it is suggested that potato (Kufri-Lima) planted on 15th October and harvested at 75 DAP and 90 DAP under micro-sprinkler irrigation method to be a good for growth parameters of potato crop under Hisar conditions.

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