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## Assessing the influence of climate on seasonal growth performance of onion

**Gulab Singh, Gautam Saha, Krishna Deo and Banasmita Barman**

**Abstract**

Consumable Alliums are imperative vegetables around the world. In India, onion is overwhelmingly developed during rabi season while around 60% took after by 20% each developed in kharif and late kharif season (Tripathy *et al.*, 2013). Varieties of diseases and pest attack especially arthropod to onions have the potentiality to diminish crop yield and quality (Lorbeer *et al.*, 2002). The experiment was consisted with four different planting times of 14<sup>th</sup> August, 21<sup>st</sup> August, 28<sup>th</sup> August, 4<sup>th</sup> September for kharif season along with three spacing schedule (15 × 10cm, 20 × 15 cm and 15 × 15 cm) during both the seasons following randomized block design with three replications. Thrips counting were started from 30 DAT (Days after transplanting) and continued till physiological maturity of onion crop from selected five plants of each plot. Eco climatic variables were monitored simultaneously. Results revealed that treatment combination P4S2 (4<sup>th</sup> September, 20cm×15cm) took maximum days (115-116 Days) to attain maturity in each year. Planting dates exerted immense effects on duration to attain different phenological phases of kharif onion as compare to spacing schedules. Treatment combination P4S2 (4<sup>th</sup> September 2014, 20×15cm) took maximum days (115-116 Days) to attain maturity in each year. Tallest onion plants were observed for P3S2 (28<sup>th</sup> August, 20×15cm). Whereas, the treatment differences were highly significant due to date of planting especially during 14-84 DAP. Very less treatment differences in plant height were analyzed for spacing scheduling. Number of leaves/plant was significantly affected by planting dates. Maximum number of leaves/plant (13.30) was recorded for P3 (28<sup>th</sup> August) at 84 DAP. Spacing had also some effect on number of leaves / plant where maximum leaves /plant were in S2-20×15cm (11.83) at 84 DAP.

**Keywords:** Assessing, climate, seasonal growth

**Introduction**

Onion (*Allium cepa* L.) is one of the most important condiments and cash crops of Pakistan which are widely used all the year round in most of culinary dishes, regarded as a center of domestication. Onion bulb is rich in phosphorus, calcium and carbohydrates. It is pungent due to sulphuric compounds and it is an apitzer, stimulant and source of energy. Onion Thrips, *Thrips tabaci* Lindeman, is minute, phytophagous, invasive, highly fecundative, polyphagous, multivoltine, cosmopolitan and vector insect pest. It is capable of inflicting Topsovirus and Iris Yellow Spot Virus (Bunyaviridae: Topsovirus) in onion seedlings across the world The attack of thrips population not only kills onion seedlings, but also may cause the older crops to mature early which results in reduction of yields. Weather plays a critical void in abundance or regulation of pest dynamics. It has been reported from United States of America (USA) that thrips starts colonization on seeded and transplanted crop in the month of January and reach at peak in last week of August. In onions, it appears that early and late-season infestations diminish yields less than those occurring in midseason during the bulbing stage (Kuepper, 2004). At the end of the hot dry season, thrips populations are at their maximum. In some places it is better not to plant under these conditions because thrips control is almost impossible. If the only crop in the dry season is onions there should be an onion free period (2-3 weeks) before each planting to interrupt the thrips cycle by removing host plants (Reuda and Shelton, 2000).

**Methodology**

Most of the onion farmers in West Bengal are presently interested to cultivate kharif onion where pest infestation problems are less compare to other season. To compare the seasonal fluctuation of pest dynamics mainly thrips infestation in onion experiment was conducted at agricultural farm, Bidhan Chandra Krishi Vishwavidyalaya, Mohanpur, West Bengal (22°57' N latitude, 88°20' E longitude and 7.8 m altitude)

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during Kharif and Rabi season of 2015 -2016. The experiment included four different planting dates at 7 days intervals *viz.* 14<sup>th</sup> August, 21<sup>st</sup> August, 28<sup>th</sup> August, 4<sup>th</sup> September for kharif season and 1<sup>st</sup> November, 8<sup>th</sup> November, 15<sup>th</sup> November, 22<sup>nd</sup> November for rabi season. The average ambient temperature remained 24.93°C and 22.34°C during Kharif and rabi season respectively. Total precipitation measured as 326.20mm and 51.30mm respective for kharif and rabi season (Fig 1).

Three spacing schedules as 15 × 10cm, 20 × 15 cm and 15 × 15 cm were maintained during both the seasons. The experiment was laid out under randomized block design and

replicated thrice. The plot size was 1.5 m × 4 m. Phenological phases were observed as Phase 1-First leaf, Phase 2-Third leaf, Phase 3-Fifth leaf, Phase 4-Just initiation of Bulb and Phase 5-Physiological maturity. Based on occurrence of different phenophases duration to reach various phases were calculated. Five plants were selected randomly from each plot and tagged to measure height of plant at successive growth stages of crop. It was measured with the help of meter scale close to soil surface to the tips of fully opened leaves. Number of leaves per plant was counted from each previously selected and tagged plant.

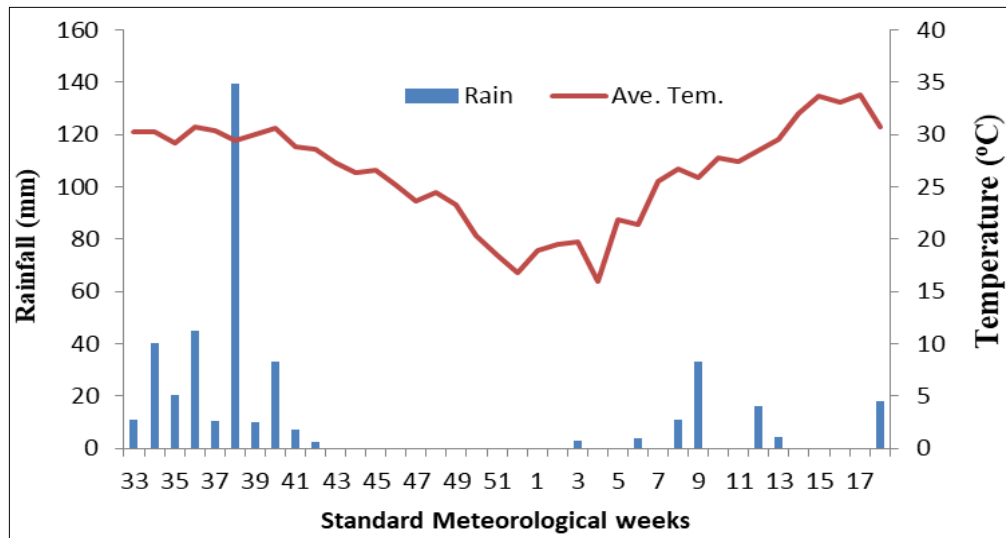


Fig 1: Temperature and Rainfall pattern during crop growing season were plotted

## Result and Discussion

### 1. Phenology

As discussed in the chapter of materials and methods different phenological phases of onion were observed and the results have been summarized in table 1 of experiment conducted in 2014 and in the table 2 of the experiment conducted in 2015. Dates of planting had immense effect on duration to reach different phenological phases of onion. To initiate first leaf after planting under different planting dates ranged from 7.6 to 9.8 days whereas from third leaf to bulb initiation crop planted on 4<sup>th</sup> September, 2014 (P<sub>4</sub>) takes maximum days to attain the phases. To complete onion life cycle P<sub>4</sub> (4<sup>th</sup> September 2014) takes maximum duration of 116 days. The treatment differences were significant.

Spacing had very less impact on the initiation of different phases of onion during 2014 where non-significant differences among the treatments were analyzed. The mixed effect of planting dates and spacing to initiate different phases were very less. However, significant changes were noted during emergence of fifth leaf.

During 2015, initiation of first leaf stage was also remarkably affected by date of planting. Crop planted on 4<sup>th</sup> September (P<sub>4</sub>) had same effect on different phenophases which was statistically at par with 2014. To complete the entire growth cycle, onion takes 111 to 115 days under different planting dates. Spacing and mixed effect were at par with 2014.

Different environmental factors affect the development and growth of crop primarily by influencing their physiological activity. In the present study, favorable weather condition under later date of planting accelerates the plants vegetative growth which was continued for long time. After that, increase in ambient temperature was preferred by the crop for

bulbing which might delay the maturity. Actually photoperiod (day length) might play a key role here in attaining different phenophases. Study of Okporie and Ekpe, (2008) [10] revealed that onions react to day length for bulb initiation. There are evidences that delayed sowing date accelerated the emergence of onion seedlings in Iran (Ansari, 2007) [11].

However, in the present study increase in more number of leaves under early date of plantings resulted in late maturity. This may be explained on the basis of findings of Butt (1968) [4] who reported that young seedlings do not respond to bulbing stimulus as rapidly as older ones and which might have attributed to more number of days to maturity. Vegetative growth and bulb formation are greatly influenced by growing environment (Rahim and Fordham, 1988) [7]. Various factors including cultivar selection, plant size, nutritional treatment, temperature, light interception have the potentiality to affect bulb formation as well as maturity of onions (Mondal *et al.*, 1986; Sinclair, 1989) [8, 9].

### 2. Plant height

Plant height of onion were measured and the results have been summarized in table 3 of experiment conducted in 2014 and in the table 4 of the experiment conducted in 2015. Plant height under different planting dates ranged from 12.08cm where the crop was planted on P<sub>4</sub> (4<sup>th</sup> September 2014) to 14.79 cm where the crop was planted on P<sub>3</sub> (28<sup>th</sup> August 2014) at 14DAP where the treatment differences were significant. Maximum plant height was observed at 84DAP (59 cm) where the crop was planted on P<sub>3</sub> (28<sup>th</sup> August 2014). During 2014, maximum plant height was recorded in P<sub>1</sub> (14<sup>th</sup> August 2014) and P<sub>3</sub> (28<sup>th</sup> August 2014). The overall treatment differences due to date of planting were significant

from 14-84DAP at 15 days interval.

In case of spacing, S<sub>2</sub> (20×15cm) showed maximum increasing trends of plant height up to 84DAP starting from 14DAP. Significant treatment differences were analyzed at 28DAP and 70DAP whereas; at other corresponding dates of planting treatment differences were non-significant. Mixed effect of dates of planting and spacing on plant height of onion had no significant treatment differences. During kharif season of 2015, same trend of plant height was observed where P<sub>1</sub> (14<sup>th</sup> August 2015) and P<sub>3</sub> (28<sup>th</sup> August 2014) showed maximum plant height and treatment differences were significant. Among different spacing, S<sub>2</sub> (20×15cm) showed maximum plant height where except 28 and 70DAP treatment differences were non-significant supporting the same trend of 2014. Interaction effect showed non-significant changes on plant height.

As per field data plants were taller with earliest planting date

at most of the stages of crop growth. The results are in conformity with the findings of Ibrahim and Adesiyun (2010a)<sup>[6]</sup> and Singh *et al.* (2002)<sup>[12]</sup> where they reported that early planting favored increase with the plant height due to availability of favorable weather during crop growth period. The result is also in agreement with the findings of Badaruddin and Haque (1977)<sup>[3]</sup> who observed the similar trend of reduction in plant height with delayed planting under Bangladesh condition.

Evidently the younger seedlings produced taller plants in the present study at all stages of crop growth. In this investigation, younger plants resumed vegetative growth more quickly. Nesmith (1983)<sup>[14]</sup> reported that if transplanting were delayed crop may pass the optimum time in which they are making active growth. Earlier studies already reported higher plant height with younger transplants compared to older ones (Norman 1992, Oladiram and Sangodele, 1996)<sup>[15, 13]</sup>.

**Table 1:** Computation of duration to reach different phenological phases of onion as influenced by dates of planting and spacing during Kharif Season of 2014

2014 (Kharif Season)						
Treatments	1 <sup>st</sup> leaf	3 <sup>rd</sup> leaf	5 <sup>th</sup> leaf	Initiation of bulb	Physiological maturity	Harvesting
P <sub>1</sub>	8.44	23.33	39.56	53.78	89.67	111.00
P <sub>2</sub>	7.67	23.67	39.67	54.67	89.67	113.00
P <sub>3</sub>	8.33	23.11	40.89	54.00	92.00	114.00
P <sub>4</sub>	9.89	25.00	43.67	55.00	91.33	116.00
SEm (±)	0.25	0.22	0.20	0.22	0.23	0.00
CD at 5%	0.75	0.65	0.59	0.66	0.69	0.00
S <sub>1</sub>	8.75	23.92	40.92	54.75	90.83	113.50
S <sub>2</sub>	8.67	23.58	41.00	53.83	90.58	113.50
S <sub>3</sub>	8.33	23.83	40.92	54.50	90.58	113.50
SEm (±)	0.22	0.19	0.17	0.19	0.20	0.00
CD at 5%	NS	NS	NS	0.57	NS	0.00
P <sub>1</sub> S <sub>1</sub>	8.33	23.33	40.00	54.00	89.67	111.00
P <sub>2</sub> S <sub>1</sub>	8.33	24.00	40.00	55.33	90.33	113.00
P <sub>3</sub> S <sub>1</sub>	8.67	23.33	40.67	54.00	91.67	114.00
P <sub>4</sub> S <sub>1</sub>	9.67	25.00	43.00	55.67	91.67	116.00
P <sub>1</sub> S <sub>2</sub>	8.67	23.33	39.00	53.33	90.00	111.00
P <sub>2</sub> S <sub>2</sub>	7.00	23.33	39.33	54.00	89.00	113.00
P <sub>3</sub> S <sub>2</sub>	8.67	23.33	41.67	53.67	92.00	114.00
P <sub>4</sub> S <sub>2</sub>	10.33	24.33	44.00	54.33	91.33	116.00
P <sub>1</sub> S <sub>3</sub>	8.33	23.33	39.67	54.00	89.33	111.00
P <sub>2</sub> S <sub>3</sub>	7.67	23.67	39.67	54.67	89.67	113.00
P <sub>3</sub> S <sub>3</sub>	7.67	22.67	40.33	54.33	92.33	114.00
P <sub>4</sub> S <sub>3</sub>	9.67	25.67	44.00	55.00	91.00	116.00
SEm (±)	0.44	0.38	0.35	0.39	0.41	0.00
CD at 5%	NS	NS	1.02	NS	NS	0.00

Kharif Season: Dates of planting as P<sub>1</sub>-14<sup>th</sup> August, 2014; P<sub>2</sub>-21<sup>st</sup> August, 2014; P<sub>3</sub>-28<sup>th</sup> August., 2014; P<sub>4</sub>-4<sup>th</sup> September 2014; Spacing as S<sub>1</sub>-15×10cm; S<sub>2</sub>-20×15cm; S<sub>3</sub>-15×15cm]

**Table 2:** Computation of duration to reach different phenological phases of onion as influenced by dates of planting and spacing during Kharif Season of 2015

2015 (Kharif Season)						
Treatments	1 <sup>st</sup> leaf	3 <sup>rd</sup> leaf	5 <sup>th</sup> leaf	Initiation of bulb	Physiological maturity	Harvesting
P <sub>1</sub>	8.44	23.56	39.78	53.89	89.78	111.00
P <sub>2</sub>	7.89	23.89	39.33	54.67	90.00	112.00
P <sub>3</sub>	9.44	23.11	41.00	53.56	92.00	114.00
P <sub>4</sub>	9.67	25.22	43.44	55.11	91.33	115.00
SEm (±)	0.23	0.28	0.24	0.21	0.28	0.00
CD at 5%	0.68	0.83	0.69	0.61	0.82	0.00
S <sub>1</sub>	9.08	24.00	40.83	54.67	91.08	113.00
S <sub>2</sub>	8.58	24.00	41.17	54.00	90.67	113.00
S <sub>3</sub>	8.92	23.83	40.67	54.25	90.58	113.00
SEm (±)	0.20	0.25	0.20	0.18	0.24	0.00
CD at 5%	NS	NS	NS	0.53	NS	0.00
P <sub>1</sub> S <sub>1</sub>	8.67	23.33	40.00	54.00	90.33	111.00

P <sub>2</sub> S <sub>1</sub>	8.00	24.00	39.67	55.33	90.67	112.00
P <sub>3</sub> S <sub>1</sub>	9.67	23.33	40.67	53.67	91.67	114.00
P <sub>4</sub> S <sub>1</sub>	10.00	25.33	43.00	55.67	91.67	115.00
P <sub>1</sub> S <sub>2</sub>	8.33	24.00	39.67	53.67	89.67	111.00
P <sub>2</sub> S <sub>2</sub>	7.67	24.00	39.33	54.00	89.67	112.00
P <sub>3</sub> S <sub>2</sub>	9.00	23.33	41.67	53.67	92.00	114.00
P <sub>4</sub> S <sub>2</sub>	9.33	24.67	44.00	54.67	91.33	115.00
P <sub>1</sub> S <sub>3</sub>	8.33	23.33	39.67	54.00	89.33	111.00
P <sub>2</sub> S <sub>3</sub>	8.00	23.67	39.00	54.67	89.67	112.00
P <sub>3</sub> S <sub>3</sub>	9.67	22.67	40.67	53.33	92.33	114.00
P <sub>4</sub> S <sub>3</sub>	9.67	25.67	43.33	55.00	91.00	115.00
SEm (±)	0.40	0.49	0.41	0.36	0.49	0.00
CD at 5%	NS	NS	NS	NS	NS	0.00

Kharif Season: Date of planting as P<sub>1</sub>-14<sup>th</sup> August, 2015; P<sub>2</sub>-21<sup>st</sup> August, 2015; P<sub>3</sub>-28<sup>th</sup> August., 2015; P<sub>4</sub>-4<sup>th</sup> September 2015; Spacing as S<sub>1</sub>-15×10cm; S<sub>2</sub>-20×15cm; S<sub>3</sub>-15×15cm]

**Table 3:** Measurement of plant height (cm) of onion as influenced by dates of planting and spacing during Kharif season of 2014

2014 (Kharif Season)						
Days after planting						
Treatments	14	28	42	56	70	84
P <sub>1</sub>	14.76	20.17	25.83	35.99	56.23	57.20
P <sub>2</sub>	13.40	19.46	28.11	47.81	54.00	54.86
P <sub>3</sub>	14.79	18.03	22.84	36.00	53.53	58.93
P <sub>4</sub>	12.08	15.20	26.74	40.29	45.93	54.96
SEm (±)	0.69	0.61	1.73	1.35	1.14	1.08
CD at 5%	2.03	1.80	NS	3.96	3.35	3.16
S <sub>1</sub>	13.80	16.88	24.02	38.45	50.29	55.57
S <sub>2</sub>	13.70	19.11	27.69	41.31	54.90	58.21
S <sub>3</sub>	13.76	18.65	25.94	40.31	52.09	55.69
SEm (±)	0.60	0.53	1.50	1.17	0.99	0.93
CD at 5%	NS	1.56	NS	NS	2.90	NS
P <sub>1</sub> S <sub>1</sub>	14.17	17.84	23.39	34.81	55.51	57.37
P <sub>2</sub> S <sub>1</sub>	13.07	17.04	25.53	45.49	50.19	53.57
P <sub>3</sub> S <sub>1</sub>	14.27	18.25	22.27	34.35	50.87	56.20
P <sub>4</sub> S <sub>1</sub>	13.70	14.38	24.87	39.14	44.59	55.13
P <sub>1</sub> S <sub>2</sub>	15.57	21.08	27.85	35.53	56.30	57.91
P <sub>2</sub> S <sub>2</sub>	12.53	20.83	29.74	49.72	58.71	57.11
P <sub>3</sub> S <sub>2</sub>	15.38	18.83	25.40	37.79	54.93	60.63
P <sub>4</sub> S <sub>2</sub>	11.33	15.70	27.78	42.21	49.64	57.18
P <sub>1</sub> S <sub>3</sub>	14.54	21.58	26.25	37.64	56.87	56.33
P <sub>2</sub> S <sub>3</sub>	14.61	20.51	29.06	48.23	53.11	53.89
P <sub>3</sub> S <sub>3</sub>	14.71	17.00	20.87	35.87	54.80	59.97
P <sub>4</sub> S <sub>3</sub>	11.19	15.53	27.57	39.52	43.57	52.57
SEm (±)	1.20	1.06	2.99	2.34	1.98	1.87
CD at 5%	NS	NS	NS	NS	NS	NS

Kharif Season: Date of planting as P<sub>1</sub>-14<sup>th</sup> August, 2014; P<sub>2</sub>-21<sup>st</sup> August, 2014; P<sub>3</sub>-28<sup>th</sup> August., 2014; P<sub>4</sub>-4<sup>th</sup> September 2014; Spacing as S<sub>1</sub>-15×10cm; S<sub>2</sub>-20×15cm; S<sub>3</sub>-15×15cm]

**Table 4:** Measurement of plant height (cm) of onion as influenced by dates of planting and spacing during Kharif season of 2015

2015 (Kharif Season)						
Days after planting						
Treatments	14	28	42	56	70	84
P <sub>1</sub>	14.92	20.33	26.00	36.16	56.39	57.37
P <sub>2</sub>	13.64	19.79	28.44	48.14	54.33	55.19
P <sub>3</sub>	14.32	17.56	22.38	35.53	53.07	58.47
P <sub>4</sub>	12.78	15.90	27.44	40.99	46.63	55.66
SEm (±)	0.79	0.61	1.77	1.43	1.12	1.00
CD at 5%	NS	1.80	NS	4.20	3.29	NS
S <sub>1</sub>	13.91	17.06	24.20	38.63	50.47	55.75
S <sub>2</sub>	13.89	19.29	27.88	41.49	55.08	58.39
S <sub>3</sub>	13.95	18.84	26.12	40.50	52.27	55.87
SEm (±)	0.68	0.53	1.54	1.24	0.97	0.87
CD at 5%	NS	1.56	NS	NS	2.85	NS
P <sub>1</sub> S <sub>1</sub>	14.34	18.01	23.56	34.97	55.67	57.53
P <sub>2</sub> S <sub>1</sub>	13.10	17.37	25.87	45.82	50.52	53.91
P <sub>3</sub> S <sub>1</sub>	13.80	17.78	21.80	33.88	50.40	55.73
P <sub>4</sub> S <sub>1</sub>	14.40	15.08	25.57	39.84	45.29	55.83

P <sub>1</sub> S <sub>2</sub>	15.73	21.25	28.01	35.69	56.47	58.07
P <sub>2</sub> S <sub>2</sub>	12.87	21.17	30.07	50.05	59.04	57.44
P <sub>3</sub> S <sub>2</sub>	14.92	18.36	24.93	37.32	54.47	60.17
P <sub>4</sub> S <sub>2</sub>	12.03	16.40	28.48	42.91	50.34	57.88
P <sub>1</sub> S <sub>3</sub>	14.70	21.75	26.41	37.81	57.04	56.49
P <sub>2</sub> S <sub>3</sub>	14.95	20.84	29.39	48.56	53.44	54.23
P <sub>3</sub> S <sub>3</sub>	14.24	16.53	20.40	35.40	54.33	59.50
P <sub>4</sub> S <sub>3</sub>	11.89	16.23	28.27	40.22	44.27	53.27
SEm (±)	1.37	1.06	3.07	2.48	1.94	1.74
CD at 5%	NS	NS	NS	NS	NS	NS

Kharif Season: Date of planting as P<sub>1</sub>-14<sup>th</sup> August, 2015; P<sub>2</sub>-21<sup>st</sup> August, 2015; P<sub>3</sub>-28<sup>th</sup> August., 2015; P<sub>4</sub>-4<sup>th</sup> September 2015; Spacing as S<sub>1</sub>-15×10cm; S<sub>2</sub>-20×15cm; S<sub>3</sub>-15×15cm]

**Table 5:** Measurement of number of leaves/plant of onion as influenced by dates of planting and spacing during Kharif season of 2014

2014 (Kharif Season)						
Days after planting						
Treatments	14	28	42	56	70	84
P <sub>1</sub>	2.41	3.46	3.97	6.06	8.79	12.03
P <sub>2</sub>	2.27	3.69	4.00	6.22	9.09	12.87
P <sub>3</sub>	2.19	3.34	3.57	5.23	8.13	13.30
P <sub>4</sub>	2.18	3.07	4.33	5.24	5.82	6.58
SEm (±)	0.08	0.09	0.15	0.13	0.16	0.23
CD at 5%	NS	0.28	0.43	0.37	0.46	0.66
S <sub>1</sub>	2.18	3.22	3.87	5.45	7.72	10.58
S <sub>2</sub>	2.32	3.53	4.12	5.87	8.07	11.83
S <sub>3</sub>	2.28	3.42	3.92	5.75	8.09	11.17
SEm (±)	0.07	0.08	0.13	0.11	0.13	0.19
CD at 5%	NS	0.24	NS	0.32	NS	0.57
P <sub>1</sub> S <sub>1</sub>	2.23	3.17	3.97	5.63	8.83	11.10
P <sub>2</sub> S <sub>1</sub>	2.13	3.40	4.07	6.00	9.13	12.60
P <sub>3</sub> S <sub>1</sub>	2.23	3.30	3.50	5.23	7.30	12.57
P <sub>4</sub> S <sub>1</sub>	2.13	3.00	3.93	4.93	5.60	6.07
P <sub>1</sub> S <sub>2</sub>	2.57	3.70	3.90	6.30	8.37	13.43
P <sub>2</sub> S <sub>2</sub>	2.40	3.80	4.07	6.40	8.80	13.13
P <sub>3</sub> S <sub>2</sub>	2.10	3.50	3.77	5.17	9.17	13.90
P <sub>4</sub> S <sub>2</sub>	2.20	3.13	4.73	5.60	5.93	6.87
P <sub>1</sub> S <sub>3</sub>	2.43	3.50	4.03	6.23	9.17	11.57
P <sub>2</sub> S <sub>3</sub>	2.27	3.87	3.87	6.27	9.33	12.87
P <sub>3</sub> S <sub>3</sub>	2.23	3.23	3.43	5.30	7.93	13.43
P <sub>4</sub> S <sub>3</sub>	2.20	3.07	4.33	5.20	5.93	6.80
SEm (±)	0.13	0.16	0.25	0.22	0.27	0.39
CD at 5%	NS	NS	NS	NS	0.79	NS

Kharif Season: Date of planting as P<sub>1</sub>-14<sup>th</sup> August, 2014; P<sub>2</sub>-21<sup>st</sup> August, 2014; P<sub>3</sub>-28<sup>th</sup> August., 2014; P<sub>4</sub>-4<sup>th</sup> September 2014; Spacing as S<sub>1</sub>-15×10cm; S<sub>2</sub>-20×15cm; S<sub>3</sub>-15×15cm]

**Table 6:** Measurement of number of leaves/plant of onion as influenced by dates of planting and spacing during Kharif season of 2015

2015 (Kharif Season)						
Days after planting						
Treatments	14	28	42	56	70	84
P <sub>1</sub>	2.44	3.49	4.00	6.09	8.82	12.07
P <sub>2</sub>	2.20	3.62	3.93	6.16	9.02	12.80
P <sub>3</sub>	2.16	3.31	3.53	5.20	8.10	13.27
P <sub>4</sub>	2.24	3.13	4.40	5.31	5.89	6.64
SEm (±)	0.06	0.07	0.12	0.15	0.17	0.18
CD at 5%	0.16	0.20	0.37	0.45	0.51	0.53
S <sub>1</sub>	2.18	3.22	3.87	5.45	7.72	10.58
S <sub>2</sub>	2.32	3.53	4.12	5.87	8.07	11.83
S <sub>3</sub>	2.28	3.42	3.92	5.75	8.09	11.17
SEm (±)	0.05	0.06	0.11	0.13	0.15	0.16
CD at 5%	NS	0.18	NS	NS	NS	0.46
P <sub>1</sub> S <sub>1</sub>	2.27	3.20	4.00	5.67	8.87	11.13
P <sub>2</sub> S <sub>1</sub>	2.07	3.33	4.00	5.93	9.07	12.53
P <sub>3</sub> S <sub>1</sub>	2.20	3.27	3.47	5.20	7.27	12.53
P <sub>4</sub> S <sub>1</sub>	2.20	3.07	4.00	5.00	5.67	6.13
P <sub>1</sub> S <sub>2</sub>	2.60	3.73	3.93	6.33	8.40	13.47
P <sub>2</sub> S <sub>2</sub>	2.33	3.73	4.00	6.33	8.73	13.07
P <sub>3</sub> S <sub>2</sub>	2.07	3.47	3.73	5.13	9.13	13.87

P <sub>4</sub> S <sub>2</sub>	2.27	3.20	4.80	5.67	6.00	6.93
P <sub>1</sub> S <sub>3</sub>	2.47	3.53	4.07	6.27	9.20	11.60
P <sub>2</sub> S <sub>3</sub>	2.20	3.80	3.80	6.20	9.27	12.80
P <sub>3</sub> S <sub>3</sub>	2.20	3.20	3.40	5.27	7.90	13.40
P <sub>4</sub> S <sub>3</sub>	2.27	3.13	4.40	5.27	6.00	6.87
SEm (±)	0.10	0.12	0.22	0.27	0.30	0.31
CD at 5%	NS	NS	NS	NS	0.88	NS

Kharif Season: Date of planting as P<sub>1</sub>-14<sup>th</sup> August, 2015; P<sub>2</sub>-21<sup>st</sup> August, 2015; P<sub>3</sub>-28<sup>th</sup> August., 2015; P<sub>4</sub>-4<sup>th</sup> September 2015; Spacing as S<sub>1</sub>-15×10cm; S<sub>2</sub>-20×15cm; S<sub>3</sub>-15×15cm]

### 3. Number of leaves/plant

Number of leaves / plant was recorded at six different dates of 15 days interval as summarized in table 5 of the experiment conducted in 2014 and in table 6 of the experiment conducted in 2015. Maximum increase in Number of leaves / plant (13.30) was recorded at 84 DAP in P<sub>3</sub> (28<sup>th</sup> August. 2014) dates of planting and the treatment differences were significant except 14DAP. Spacing had some effect on Number of leaves / plant where maximum leaves /plant was for S<sub>2</sub>-20×15cm (11.83) followed by S<sub>3</sub>-15×15cm (11.17 cm) and S<sub>1</sub>-15×10cm (10.58) during 84DAP. Treatment differences were not significant for 14, 42 and 70DAP. During 70DAP treatment differences were significant only for mixed effect of date of planting and spacing.

During 2015, P<sub>3</sub> (28<sup>th</sup> August. 2015) also resulted in maximum number of leaves / plant whereas P<sub>4</sub> (4<sup>th</sup> September. 2014) provided minimum number of leaves /plant. At 14DAP treatment differences due to planting dates were non-significant but in the later growth stages significant variations have been analyzed. Spacing had very less effect on number of leaves / plant. Only at 14 and 84DAP treatment differences were significant. There was no fruitful effect due to mixed action of planting and spacing in combination.

The number of leaves as affected by planting dates also showed a declining trend under present study with the delayed planting at different stages of crop growth. This may be attributed to rain and fully sunny days in the early sowing dates which also promoted maximum vegetative growth. Similar results have been reported by Anisuzzaman *et al.* (2009) [2], Singh *et al.* (2002) [12] and Hussain and Islam (1994) [5]. In the present study, increased number of leaves per plant has been accompanied by taller plants which were supported by Anisuzzaman *et al.* (2009) [2].

The improvement in number of leaves per plant in early seedlings could be attributed to greater plant height under the selected treatments. Rahman *et al.* (2002) [11] exhibited strong positive correlation of plant height with leaf number per plant.

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