Environment and Ecology 42 (1A) : 285—292, January—March 2024
Article DOI: https://doi.org/10.60151/envec/EEVG1351
ISSN 0970-0420

Selection of Suitable Date of Transplanting for Year Round Production of Onion (*Allium cepa* L.) cv Agrifound Dark Red

Maya Ram, Sutanu Maji, Razauddin, Mata Prasad, Ramesh Chand Meena

Received 4 August 2023, Accepted 12 December 2023, Published on 6 March 2024

ABSTRACT

Round the year onion production is an important issue to challenge the price fluctuation during different time of year and different location of the country. The present experiment was conducted at sub-tropical region of Uttar Pradesh during early *kharif*, *kharif* and late *kharif* season of 2021-22 and 2022-23 to find out the optimum date of transplanting and choice of suitable planting condition (raised and flat bed) for Agrifound Dark Red cultivar of onion for off-season production. The experiment consisted of nine dates of transplanting (1st day of April, May, June, July, August, September, October, November and December). Based on two years data of experiment which was laid out in two Factorial Randomized Block Design with three replications, results indicated that transplanting on 1st October showed maximum vegetative growth in terms of plant height (66.23 cm), number of leaves per plant (13.32), length of leaf (65.85 cm) was observed in plants when transplanted on 1st November (D_8) at 120 days after transplanting (DAT). However, maximum neck thickness (21.92 mm) was recorded in 1st October transplanting, but the change was non-significant. The harvesting days might be early when transplanting was done on 1st July (D_4) and October transplanting (D_7) caused late harvesting as compared to others. It indicated that 1st October transplanting produced more bulb yield (347.76 q/ha) followed by 1st November transplanting. Among the two conditions, raised bed (B_1) showed the better performance in respect of growth and yield specially in *kharif* season production. Therefore, it may be concluded that Agrifound Dark Red variety may be transplanted on 1st October to get maximum production in central Uttar Pradesh which may be beneficial for increasing farmers' income.

Keywords Date of transplanting, Transplanting, Onion, Offseason, *Kharif*, Growth, Yield.

INTRODUCTION

Onion (*Allium cepa* L.), member of Alliaceae family (2n= 2x=16) (Meghana *et al.* 2021), is one of the most important bulb crops commercially cultivated worldwide for fresh consumption both in the green stage as well as mature bulbs and also as value-added products. It is valued for its bulbs having a characteristic odour, flavor and pungency due to presence of ally-propyl-disulphide (Kumar *et al.* 2017). Onion

Maya Ram[1], Sutanu Maji[2]*, Razauddin[3], Mata Prasad[4], Ramesh Chand Meena[5]

[2]Assistant Professor
[1, 2, 3, 4, 5]Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University, Lucknow 226025, UP, India

Email : majisutanu@gmail.com
*Corresponding author

is the richest source of flavonoids in the human diet and that has been associated with a reduced risk of cancer, heart disease, diabetes (Lombar 2000), (Yadav *et al.* 2015). It is also known for its anti-allergenic, anti-bacterial, antiviral and anti-inflammatory potential. India is the largest producer of onions (19.14 mha, 31.14 t/ha) after China and Maharashtra is the leading onion producing state in India with 32% share (Anon 2022). In India, onions are mostly grown as *rabi* crop, which is harvested in April-May, stored and slowly made available for domestic supply as well as export up to September-October. Therefore, the price of onions increases due to decreasing availability during October to March. A good harvest in the *kharif* season can bridge the gap between demand and supply of onions during the dearth period. The offseason onion provides a high price as compared to the main *rabi* season onion. Selection of proper date of transplanting is very important since date of transplanting had significant effect (Prasad *et al*. 2017). Date of transplanting also determine the effect of edaphic factors and environmental conditions on growth, yield and bulb quality. It might be varied according to region. Therefore, standardization of suitable date of transplanting is very important to maximise bulb yield and its quality of onion (Sharief *et al.* 2013). Level of soil in the field is also a considerable factor science it affects the water condition on soil influencing crop growth and development. Generally two bed conditions i.e. raised and flat are opted as per weather condition of that region, especially during rainy season. Due to lack of technical knowledge on this aspect, the onion growers of these regions are suffering to a great extent, not only due to low bulb production but also due to problems in keeping the quality of bulbs specially in *kharif* season production. Therefore, the present study has been conducted to find the suitable date for transplanting and bed condition in main field for production of onion throughout the year to increase farmers' income as well as to reduce the gap between demand and supply.

MATERIALS AND METHODS

The experiment was conducted at Horticulture Research Farm in the Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University, Lucknow, Uttar Pradesh, India during 2021-22 and 2022-23 located at 26°50' N, 80°52'E, 123 m MSL. The experimental site comes under sub-tropical climate having moderate dry summer and medium annual rainfall. The experiment consisted of nine different transplanting dates (D_1-1st April, D_2-1st May, D_3-1st June, D_4-1st July, D_5-1st August, D_6-1st September, D_7-1st October, D_8-1st November, D_9-1st December) and two condition Raised bed (B_1) and Flat bed (B_2) and one cultivar viz., Agrifound Dark Red. Transplanting was done on 1m × 0.75 m plots at 10 cm × 15 cm spacing. Truthfully labeled seeds of the selected onion cultivar were collected from National Horticultural Research and Development Foundation, New Delhi, India. Seeds were sown in the nursery on 10th February for transplanting on 1st April and on subsequent dates as per the date of transplanting in the experimental design to get seedlings of uniform age of about 50 days old for transplanting.The entire recommended package of practices was adapted to all treatments uniformly to raise a good crop. Plots were irrigated at intervals of 7-10 days until maturity depending on weather condition. During maturity, when 2/3rd of the leaves become yellow in color with neck fall, the bulbs were harvested and cured for short period for 5 days. Sample bulbs were taken from each plot for data collection. Data were collected on vegetative growth parameters (plant height, leaf length, number of leaves/plant, neck thickness) and yield per ha along with average bulb weight. Observed data were analyzed as per standard methods (Sahu and Das 2009) for factorial RBD (2 factors) and treatment means were compared at 5% level of significance.

RESULTS

Effect of different date of transplanting on plant height and number of leaves in onion

On the basis of two years pooled data (Table 1) (2021-22 and 2022-23) the maximum plant height (66.23 cm) was found at 120 days after transplanting (DAT) when transplanting was done on 1st November (D_8) followed by 1st December (D_9). Among the two condition raised bed (B_1) showed the tallest plants (66.85 cm and 66.54 cm in 2021-22 and 2022-23, respectively) compared to the Flat bed (B_2) (65.50 cm and 64.51 cm in two years, respectively). The

Table 1. Effect of date of transplanting and type of bed on plant height (cm) of onion cv Agrifound Dark Red at 120 DAT. NS – Non significant D_1-1st April, D_2-1st May, D_3-1st June, D_4-1st July, D_5-1st August, D_6-1st September, D_7-1st October, D_8-1st November, D_9-1st December.

				Plant height (cm) at 120 DAT					
		Bed							
		1st year			2nd year			Pooled	
Date	B_1	B_2	Mean	B_1	B_2	Mean D	B_1	B_2	Mean D
D_1	66.55	65.41	65.98	66.55	64.12	65.33	66.55	64.77	65.66
D_2	66.44	65.85	66.14	65.49	64.84	65.17	65.97	65.35	65.66
D_3	66.42	65.11	65.76	65.69	64.31	65.00	66.05	64.71	65.38
D_4	66.78	65.61	66.19	66.46	63.97	65.22	66.62	64.79	65.71
D_5	66.99	65.20	66.09	66.22	64.70	65.46	66.61	64.95	65.78
D_6	66.46	65.78	66.12	66.80	64.56	65.68	66.63	65.18	65.90
D_7	67.53	65.47	66.50	67.34	64.23	65.79	67.44	64.85	66.15
D_8	67.36	65.54	66.45	67.20	64.81	66.01	67.28	65.18	66.23
D_9	67.13	65.54	66.33	67.10	65.02	66.06	67.12	65.28	66.20
Mean	66.85	65.50		66.54	64.51		66.70	65.01	
SEm±	Factor (D)	0.81		0.47			0.49		
	Factor (B)	0.38		0.22			0.23		
	Factor (D×B)	1.14		0.66			0.70		
CD (p=0.05)	Factor (D)	NS		NS			NS		
	Factor (B)	1.10		0.63			0.67		
	Factor (D×B)	NS		NS			NS		

interaction effect of both date of transplanting and cultivar was noted as statistically significant effect on plant height at 120 DAT. The maximum plant height (67.53 cm and 67.34 cm, respectively in 1st and 2nd year trial) was observed with $D_7 \times B_1$ (1st October transplanting × Raised bed) followed by $D_9 \times B_2$ (1st December transplanting × Flat bed), whereas, the minimum plant height (65.11 cm and 63.97 cm in two years respectively) was observed in D_3B_2(1st June × Flat bed).

However, it was seen that during the post monsoon and winter (October to December), the maximum plant height was measured in D_7 (29.20 cm).

Table 2. Effect of date of transplanting and type of bed on number of leaves per plant of onion cv Agrifound dark red at 120 DAT.

				Number of leaves per pant at 120 DAT					
		Bed							
		1st year			2nd year			Pooled	
Date	B_1	B_2	Mean	B_1	B_2	Mean D	B_1	B_2	Mean D
D_1	12.30	11.87	12.08	12.40	12.23	12.32	12.35	12.05	12.20
D_2	12.03	11.97	12.00	12.47	12.33	12.40	12.25	12.15	12.20
D_3	13.58	11.49	12.54	13.67	11.87	12.77	13.62	11.68	12.65
D_4	13.20	12.74	12.97	12.87	11.53	12.20	13.03	12.14	12.59
D_5	13.22	12.69	12.96	12.69	12.31	12.50	12.96	12.50	12.73
D_6	13.08	12.30	12.69	13.70	12.27	12.98	13.39	12.28	12.84
D_7	13.79	12.28	13.04	14.13	12.33	13.23	13.96	12.31	13.14
D_8	13.67	12.48	13.08	13.73	13.40	13.57	13.70	12.94	13.32
D_9	13.23	12.39	12.81	13.27	13.20	13.23	13.25	12.80	13.02
Mean	13.12	12.25		13.21	12.39		13.17	12.32	
SEm±	Factor (D)	0.53		0.60			0.51		
	Factor (B)	0.25		0.28			0.24		
	Factor (D×B)	0.74		0.85			0.73		
CD (p=0.05)	Factor (D)	NS		NS			NS		
	Factor (B)	0.71		0.81			0.70		
	Factor (D×B)	NS		NS			NS		

Table 3. Effect of date of transplanting and type of bed on maximum length of leaf (cm) of onion cv Agrifound Dark Red at 120 DAT.

		Maximum length of leaf (cm) at 120 DAT							
		Bed							
		1st year			2nd year			Pooled	
Date	B_1	B_2	Mean	B_1	B_2	Mean D	B_1	B_2	Mean D
D_1	63.79	62.64	63.22	62.64	61.97	62.31	63.22	62.30	62.76
D_2	62.68	61.97	62.33	64.87	62.68	63.78	63.78	62.33	63.05
D_3	64.87	63.61	64.24	63.61	61.72	62.66	64.24	62.66	63.45
D_4	64.03	61.56	62.80	64.10	63.79	63.94	64.06	62.68	63.37
D_5	65.57	64.64	65.10	65.61	64.71	65.16	65.59	64.67	65.13
D_6	65.33	65.02	65.18	65.56	65.11	65.34	65.45	65.06	65.26
D_7	66.37	64.84	65.61	66.74	64.81	65.77	66.56	64.82	65.69
D_8	66.18	65.33	65.76	66.48	65.40	65.94	66.33	65.37	65.85
D_9	66.05	64.77	65.41	66.09	65.43	65.76	66.07	65.10	65.59
Mean	64.99	63.82		65.08	63.96		65.03	63.89	
SEm±	Factor (D)	0.74		0.77			0.65		
	Factor (B)	0.35		0.36			0.31		
	Factor (D×B)	1.05		1.09			0.92		
CD (p=0.05)	Factor (D)	2.15		2.22			1.87		
	Factor (B)	1.01		1.05			0.88		
	Factor (D×B)	N/S		N/S			N/S		

Although it was observed maximum with $D_8 \times B_1$ (1st November transplanting × Raised bed) followed by $D_9 \times B_1$ (1st December × Raised bed), whereas, the minimum plant height (29.02 cm) was observed in $D_7 \times B_2$ (27.67 cm).

The various planting dates and cultivars also had a significant effect on the number of leaves/plant (Table 2). The moderate transplanted plants were taller than the early and late transplanted plants. The maximum number of leaves (13.32) was observed in D_8 (1st November) followed by D_7 (1st October). Cultivar Agrifound Dark Red produced the highest number of leaves Raised bed (B_1) (13.12 cm and 13.21 cm in 2021-22 and 2022-23, respectively), followed by the Flat bed (B_2) (12.25 cm and 12.39 cm in two

Table 4. Effect of date of transplanting and type of bed on neck thickness (mm) of onion cv. Agrifound Dark Red at 120 DAT.

		Neck thickness (mm) at 120 DAT							
		Bed							
		1st year			2nd year			Pooled	
Date	B_1	B_2	Mean	B_1	B_2	Mean D	B_1	B_2	Mean D
D_1	21.10	20.82	20.96	21.55	20.78	21.17	21.32	20.80	21.06
D_2	21.03	19.57	20.30	21.89	21.37	21.63	21.46	20.47	20.96
D_3	20.52	19.49	20.01	22.28	21.08	21.68	21.40	20.29	20.84
D_4	19.45	19.03	19.24	22.29	19.52	20.91	20.87	19.28	20.07
D_5	21.31	19.79	20.55	22.33	21.98	22.16	21.82	20.89	21.36
D_6	21.07	20.84	20.95	22.20	21.53	21.86	21.63	21.18	21.41
D_7	22.15	21.27	21.71	22.56	21.71	22.13	22.36	21.49	21.92
D_8	21.74	20.28	21.01	22.35	21.01	21.68	22.05	20.65	21.35
D_9	21.62	21.36	21.49	22.20	21.53	21.87	21.91	21.44	21.68
Mean	21.11	20.27		22.18	21.17		21.65	20.72	
SEm±	Factor (D)	1.35		0.34			0.70		
	Factor (B)	0.64		0.16			0.33		
	Factor (D×B)	1.90		0.47			0.99		
CD (p=0.05)	Factor (D)	NS		NS			NS		
	Factor(B)	NS		0.46			NS		
	Factor (D×B)	NS		N/S			NS		

Table 5. Effect of date of transplanting and type of bed on days to harvesting of onion bulbs cv Agrifound Dark Red (days).

	Days to harvesting (days) from date of transplanting								
	Bed								
	1st year			2nd year			Pooled		
Date	B_1	B_2	Mean	B_1	B_2	Mean D	B_1	B_2	Mean D
D_1	141.67	140.00	140.83	140.00	138.33	139.17	140.83	139.17	140.00
D_2	145.00	140.00	142.50	143.67	139.67	141.67	144.33	139.83	142.08
D_3	141.67	136.67	139.17	142.00	140.00	141.00	141.83	138.33	140.08
D_4	145.00	140.00	142.50	145.00	129.67	137.33	145.00	134.83	139.92
D_5	145.00	140.00	142.50	141.67	139.67	140.67	143.33	139.83	141.58
D_6	145.00	140.00	142.50	140.00	138.67	139.33	142.50	139.33	140.92
D_7	155.00	145.00	150.00	149.33	137.67	143.50	152.17	141.33	146.75
D_8	150.00	149.00	149.50	145.33	130.67	138.00	147.67	139.83	143.75
D_9	145.00	144.33	144.67	145.33	134.33	139.83	145.17	139.33	142.25
Mean	145.93	141.67		143.59	136.52		144.76	139.09	
SEm±	Factor (D)	2.98		3.30			2.01		
	Factor (B)	1.40		1.56			0.95		
	Factor (D×B)	4.21		4.67			2.85		
CD (p=0.05)	Factor (D)	NS		NS			NS		
	Factor (B)	4.05		4.50			2.74		
	Factor (D×B)	NS		NS			NS		

year, respectively). The interaction effect of both the date of transplanting and cultivar were noted as having a statistically significant on the number of leaves. However, the maximum number of leaves (13.79 and 14.13 in two years, respectively) was observed with treatment combination $D_7 \times B_1$ (1st October transplanting × Raised bed) followed by $D_8 \times B_1$(1st November transplanting × Raised bed). Whereas, the minimum number of leaves (11.49 and 11.53 in two years respectively) were observed in D_3B_2 (1st June × Flat bed) and D_4B_2 (1st July × Flat bed).

Effect of different date of transplanting on leaf length and neck thickness

The moderate transplanted plants were taller than the early *kharif, kharif* and late *kharif* transplanted plants. However, the maximum leaf length (65.85 cm) was observed in D_8 (1st November planting) followed by D_7 (1st October planting). The cultivar Agrifound Dark Red produced the tallest leaf length Raised bed (B_1) (64.99 cm and 65.08 cm in 2021-22 and 2022-23 respectively) followed by the Flat bed B_2 (63.82 cm and 63.96 cm in two years respectively). The interaction effect of both date of transplanting two condition cultivar were noted as having a statistically significant effect on leaf length (Table 3). However, the maximum leaf length (66.37 cm and 66.74 cm) was observed with $D_7 \times B_1$ (1st October × Raised bed) followed by $D_8 \times B_1$ (1st November transplanting × Raised bed).Whereas, the minimum leaf length (61.56 cm and 61.72 cm in two years respectively) was observed in $D_4 \times B_2$ (1st July × Flat bed) and $D_3 \times B_2$ (1st June × Flat bed).

Maximum neck thickness (21.92 mm) was observed in D_7 (1st October) followed by D_9 (1st December) at 120 DAT (Table 4). While, onion cultivar Agrifound Dark Red in Raised bed showed the maximum neck thickness (21.11 mm and 22.18 mm in 2021-22 and 2022-23 respectively), followed by the Flat bed B_2 (20.27 mm and 21.17 mm in two years respectively). The interaction effect of both date of transplanting and two conditions was noted as a statistically significant effect on neck thickness. Maximum neck thickness (22.56 mm × 21.74 mm) was observed with $D_7 \times B_1$ (1st October × Raised bed) and $D_8 \times B_1$ (1st November × Raised bed) followed by the $D_8 \times B_1$ (1st November × Raised bed) and $D_9 \times B_1$ (1st December × Raised bed). Whereas, the minimum neck thickness (19.03 mm and 19.52 mm in two years, respectively) was observed in $D_4 \times B_2$ (1st July × Flat bed).

Table 6. Effect of date of transplanting and type of bed on bulb yield (q/ha) of onion cv Agrifound Dark Red..

				Bulb yield (q/ha) Bed					
	1st year			2nd year			Pooled		
Date	B_1	B_2	Mean	B_1	B_2	Mean D	B_1	B_2	Mean D
D_1	310.90	308.23	309.57	328.53	324.50	326.52	319.71	316.35	318.03
D_2	317.97	310.70	314.33	342.83	326.03	334.43	330.40	318.38	324.39
D_3	359.57	326.30	342.93	326.37	312.97	319.67	342.97	319.63	331.30
D_4	336.77	305.57	321.17	318.27	295.57	306.92	327.51	300.56	314.04
D_5	338.07	310.57	324.32	301.47	296.50	298.98	319.77	303.52	311.65
D_6	327.73	309.53	318.63	343.77	338.47	341.12	335.76	324.01	329.89
D_7	376.13	312.70	344.42	361.50	340.67	351.08	368.82	326.69	347.76
D_8	369.73	324.20	346.97	345.63	331.67	338.65	357.69	327.92	342.81
D_9	328.07	309.57	318.82	318.57	313.00	315.78	323.32	311.28	317.30
Mean	340.55	313.04		331.88	319.93		336.22	316.48	
SEm ±	Factor (D)	20.24		14.66			12.64		
	Factor (B)	9.54		6.91			5.96		
	Factor (D×B)	28.62		20.74			17.87		
CD (p=0.05)	Factor (D)	NS		NS			NS		
	Factor (B)	27.54		NS			17.20		
	Factor (D×B)	NS		NS			NS		

Effect of different date of transplanting on days to harvesting of bulbs (days) and bulb yield (q/ha)

Moderate transplanted plants also had higher average days to harvesting of bulb as compared to early to late transplanted plants. However the maximum days to harvesting of bulb (146.75) was observed in D_7 (1st October transplanting) followed by D_8 (1st November transplanting) raised bed produced the higher days to harvesting of bulb (145.93 and 143.59 in 2021-22 and 2022-23, respectively), followed by the flat bed (141.67 and 136.52 in two years, respectively). The interaction effect of both the date of transplanting and cultivar were noted as having a statistically significant effect on days to harvesting of bulb (155.0 and 149.33) was observed with the $D_7 \times B_1$ (1st October transplanting × Raised bed) followed by $D_8 \times B_1$ (1st November transplanting × Raised bed) and the minimum days to harvesting of bulbs (136.67 and 129.67 in two years respectively) was observed in D_3B_2 (1st June transplanting × Flat bed) and D_4B_2 (1st July transplanting × Flat bed) (Table 5).

The various planting date and one cultivar two condition also had a significant effect on the bulb yield (quintal per hectare) (Table 6). The moderate transplanted plants were taller than the summer (April-June), monsoon (*kharif*, July-September) and post monsoon within (October-December) transplanted plants.The maximum yield per hectare (347.76 q/ha) was observed in D_7 (1st October) followed by D_8 (November) cultivar Agrifound Dark Red produced in raised bed (B_1) the highest yield per hectare (340.55 q/ha and 331.88 q/ha in 2021-22 and 2022-23, respectively). The interaction effect of both the date of transplanting and two condition raised bed and flat bed were noted as having a statistically significant effect on yield per hectare. However, the maximum yield per hectare (376.13 q/ha and 361.50 q/ha) was observed with in the $D_7 \times B_1$ (1st October × Raised bed) followed by $D_8 \times B_1$ (1st November × Raised bed) and the minimum yield per hectare (305.57 q/ha and 295.57 q/ha in two years respectively) was observed in $D_4 \times B_2$ (1st July × Flat bed).

DISCUSSION

Plants under transplanting during 1st October might get more congenial weather that was helpful for better growth and development of onion plant. Early transplanting from 1st April no rainfall and monsoon (*kharif*) received heavy rainfall which might hamper the root development causing detrimental effect on nutrient uptake and thus, impacted on overall growth of crop. Similar observations were reported by (Ishwori *et al.* 2006 and Khodadadi 2012) who

explained that planting date had significant effect on plant height. Indam Marshal produced maximum plant height throughout the growing period followed by Raised bed (Jain and Sarkar 2002) also reported different plant height for different of onion, which is in similar trend of our present experiment where Raised bed had more plant height as compared to Flat bed.

Maximum number of leaves per plant Leaf length was noted by 1st October transplanting might get more congenial weather that was helpful for better growth and development of onion plant. Early transplanting from 1st April no rainfall, monsoon (*kharif*) received heavy rainfall which might hamper the development causing detrimental effect on nutrient uptake and thus, impacted on overall growth of crop. Das (2008) also noted variation in leaf number in different dates of transplanting. In two conditions one cultivar raised bed and flat bed, raised bed produced maximum number of leaves/plant followed by the flat bed. (Chandrika and Reddy 2011) also noted the varietal different of onion in leaf number per plant. Interaction effect was noted non- significant for leaf number per plant. Number of leaves per plant did not affected by combination of various planting materials and different date of transplanting as also reported by (Nayee *et al.* 2009). However, (Mohanty 2001) found significant relationship between planting dates and cultivar.

Influence on leaf length was in line with (Khurana *et al.* 2003). Among two conditions, maximum leaf length and was noted in Raised bed. The interaction effect was also significant for leaf length 1st October resulted maximum leaf length Raised bed had more plant height as compared to flat bed.

Neck thickness is one of the important traits having relation with bulb size, bulb weight and bulb storage ability. Neck thickness varied significantly and maximum thickness was measured on 1st October transplanting in raised bed followed by planting on 1st November. Increase in neck length and diameter owing to the overall increase in bulb size and which is in the similar trend of the results of (Mahadeen 2009 and Nayee *et al.* 2009) who also got a significant result.

In the present investigation the yield showed significant response under different dates of transplanting, cultivar and two conditions. The highest yield of (3.64 kg/plot and 347.76 q/ha) was resulted when the transplanting was undertaken on 1st October, followed by planting on 1st November (3.59 kg/plot and 342.81 q/ha). Higher average bulb clearly indicated the higher yield per plot and per hectare. The weather condition particularly heavy rainfall and relative humidity during monsoon (*kharif*) dates of transplanting might create some unfavorable conditions causing reduction in growth that ultimately influenced the decrease in bulb yield production. Compact nature of soil during slight drying after heavy rainfall might also had some detrimental effect on crop growth when transplanted early. The results are also corroborated with the findings of Sharma *et al.* (2003) and Mahadeen (2009) when working on different date of transplanting of onion in rainfed semi-arid condition as well as season production.

CONCLUSION

Present investigation showed that the round the year production of onion is possible with cultivar Agrifound Dark Red. However, it is better to transplant onion during 1st October on raised bed system to get more bulb yield in central Uttar Pradesh condition.

REFERENCES

Anonymous (2022) National Horticultural Database 2021—2022 (First advance estimated) 2022.

Chandrika V, Reddy DS (2011) Response of onion genotypes (*Allium cepa* L.) to varied planting patterns in southern agro-climatic zone of Andhra Pradesh. *Res J ANGRAU* 39 (3) : 21—25.

Das TK (2008) Effect of seedling age and variety on the yield of *kharif* onion. *Orissa J Hortic* 36 (1) : 126—127.

Ishwori PG, Khatri B, Paudel GP (2006) Evaluation of different variety of onion and their transplanting times for off-season production in mid hills of Nepal. *Nepal Agricult Res J* 7 : 21—26. https://doi.org/10.3126/narj.v7i0.1862.

Jain BP, Sarkar SK (2002) Evaluation of onion varieties in *kharif* season. *Ind Agricult* 46 (1/2) : 49—53.

Khodadadi M (2012) The effects of planting date and mother bulb size on quantitative and qualitative seed traits of onion red variety. *Int J Agricult Res Review* 2 (4) : 324—327.

Khurana SC, Kumar R, Bhutani RD, Bhatia AK, Dudi BS (2003) Effect of sowing time on *kharif* onion (*Allium cepa* L.) set production. *Haryana J Horticult Sci* 32(1/2) : 134—137.

Kumar A, Ram RB, Maji S, Kishor S, Yadav R, Govind, Meena KR (2017) Effect of organic manures, biofertilizers and micronutrients growth, yield and quality of onion (*Allium cepa* L.) *Int J Agricult Sci* 13 (2) : 236—241. DOI: 10.15740/has/

ijas/13.2/236-241.

Lombar KA (2000) Investigation of the flavonol quercetin in onion (*Allium cepa* L.) by high performance liquid chromatography (HPLC) and spectrophotometric methodology. *MSc thesis. Texas Tech University*, Lubbock, TX. DOI: 10.21273/ HORTSCI.37.4.682.

Mahadeen AY (2009) Effect of planting date and plant spacing on onion (*Allium cepa* L.) yield under rain-fed in semi-arid conditions of Jordan. *Bull Faculty of Agric Cairo Univ* 59 (3) : 236—240. DOI: 10.21608/ ejarc.2008217004.

Mahanthesh B, Harshavardhan M, Thippeshappa GN, Sajjan MRP, Lakshmana (2008) Nutrient uptake and yield of onion as influenced by integrated nutrient management in rainfed onion cv Bellary red during *kharif* season. *Environ Ecol* 26 (1): 29—34.

Meghana N, Prakash K, Srinivasa V, Kantharaj Y, Kolakar SK (2021) Assesment of onion (*Allium cepa* L.) varieties for growth and yield attributes under central dry zone of Karnataka. *The Pharma Innov J* 10 (12) : 1712—1715.

Mohanty BK (2001) Effect of planting time on the performance of onion cultivars. *Veg Sci* 28 (2) : 140—142.

Nayee DD, Verma LR, Sitapara HH (2009) Effect of various planting materials and different dates of planting on growth and bolting of *kharif* onion (*Allium cepa* L.) cv Agrifound Dark Red. *Asian Sci* 4 (1) : 13—15.

Prasad B, Maji S, Meena KR (2017) Effect of date of transplanting and mulching on growth, yield and quality of onion (*Allium cepa* L.) cv Nasik Red. *J Appl Natural Sci* 9 (1) : 94—101. https://doi.org/10.31018/jans.v9i1.1156.

Sahu PK, Das A (2009) Agriculture and Applied Statistics II, Book, SN. No.978-81-272-5049-2.

Sharief AE, Kandil AA, Fathalla AH (2013) Effect of transplanting dates of some onion cultivars on vegetative growth, bulb yield and its quality. *ESci J Crop Prod* 2 (3) : 72—82.

Sharma PK, Yadav GL, Kumar S (2003) Effects of methods and dates of planting of onion sets on the bulb yield of *kharif onion News Letter. Nat Horticult Res Devel Foundation* 23 (4) : 1—3.

Yadav R, Dwivedi DH, Govind, Maji S (2015) Effect of integrated nutrient management on growth and yield of onion (*Allium cepa* L.). *J Crop Weed* 11 (1) : 49—53. DOI: 10.5958/ 2348-7542.2016.00092.9.