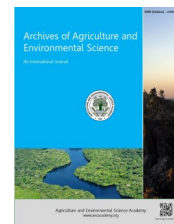




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ORIGINAL RESEARCH ARTICLE

Effect of planting method on onion (*Allium cepa* L.) bulb production in Faridpur region of Bangladesh

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ABSTRACT

The present study was undertaken to evaluate the effective planting method for onion production for motivating onion producing farmers in Faridpur region of Bangladesh during rabi season 2014-15 and 2015-16 at spices Research Sub-centre, Faridpur. The number of treatment was four viz., Raised bed + Spices Research Centre (SRC) recommended practice, Raised bed + Farmer's practice, Flat method + Spices Research Centre (SRC) recommended practice and Flat method + Farmer's practice. The onion variety BARI Piaz-1 used as planting material. The SRC recommended practice consist of seed sowing at 2nd week of November + seedlings transplanting at the end of December + Spacing (10cm × 10cm) + Irrigation (4times) + weeding (four at 15, 25, 45 and 60 DAT) + Fungicide application with Rovral and Ridomil gold (four spray when disease appears) + Insecticide application (2-3 spray when/before thrips / insect appears) + Fertilizer doses (cow dung 5 ton ha⁻¹, N₁₂₀, P₃₄, K₇₅ and S₂₀ kg ha⁻¹). On the other hand farmer's practice consist of seed sowing at last week of November in flat seed bed + seedling transplanting at 3rd week of January + Spacing (10cm × 7cm) + Irrigation (2-3 times) + Weeding (2times) + Fungicide application with Rovral, Score and other type of ineffective fungicide at 5-7 days interval + insecticide application with Confidor after thrips / insect appears + Fertilizer doses (N₄₆, P₄₅, K₃₀ and S₁₆ kg ha⁻¹). The results of the study revealed that planting method and management practices had significant impact on yield and yield attributes of onion and among the treatments the highest yield was found from Raised bed + SRC recommended practice. Significantly highest yield 14.42 t ha⁻¹ in 2014-15 and 12.57 t ha⁻¹ in 2015-16 was recorded from SRC recommended practice. The lowest yield 8.05 t ha⁻¹ in 2014-15 and 7.66 t ha⁻¹ in 2015-16 was recorded from Flat method + Farmer's practice. Therefore, the farmers of Faridpur region of Bangladesh are advised to adopt SRC recommended practice with raised bed method for increasing their annual average onion production

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INTRODUCTION

The onion (*Allium cepa* L.) belongs to the genus *Allium* of the family Alliaceae (Hanelt, 1990). Onion contributes significant nutritional value to the human diet and has medicinal properties and is primarily consumed for its unique flavor or for its ability to enhance the flavor of other foods (Randle, 2000). It is rich source of vitamin C and E (Block, 2005; El Assi and Abu-Rayyan, 2007); and

having medicinal value also (Kumar *et al.*, 2010; Bosekeng, 2012). It is one of the most important spices as well as vegetable crops of Bangladesh. It ranks first among the spices both in acreage and production (BBS, 2015). Faridpur is one of the best onion bulb producing areas in Bangladesh about 376651 MT (BBS, 2015). Farmers of Faridpur region cultivate onion in flat method without bed. They used flood irrigation system to cultivate the crops. In

most cases they apply water more than optimum level which causes water stagnancy in the field that badly hampered crop growth and drastically reduced yield. Again onion is a shallow rooted crop which need frequent irrigation. It was reported that per unit production can be increased by raised bed methods of cultivation and raised bed can save 20-34% irrigation water, 16-69% planting cost and ensure less human labour (Hossain *et al.*, 2010a). Raised beds 6–8 inches high will help to improve water drainage in poorly drained soil during rainy periods, such as the winter months (Hayslip *et al.*, 1987). Onion is a photo thermo sensitive plant (Jones and Mann, 1963) hence planting time plays an important role in onion cultivation. So, it is important to know about the optimum planting time on onion cultivation to harvest better yield. Considering the above facts, the present study was undertaken to evaluate the effective planting method for onion production for motivating onion producing farmers in Faridpur region of Bangladesh.

MATERIALS AND METHODS

The experiment was conducted during rabi season 2014-15 and 2015-16 at spices Research Sub-centre, Faridpur. The experimental field belongs to high land of Low Ganges River Floodplain (AEZ 12) with clay loam in texture and 7.6-8.1 soil pH (FAO, 1998). The experiment was conducted in randomized complete block design (RCBD) with six replications. The number of treatments were four *viz.*, Raised bed + SRC practice, Raised bed + Farmer's practice Flat method + SRC practice, Flat method + Farmer's practice. The onion variety BARI Piaz-1 was used as planting material. The SRC recommended practice consist of seed sowing at 2nd week of November + seedlings transplanting at the end of December + Spacing (10cm × 10cm) + Irrigation (4times) + weeding (four at 15, 25, 45 and 60 DAT) + Fungicide application with Rovral and Ridomil Gold (@ 0.5 g l⁻¹ of water at 35, 45, 55 and 65 DAT. + Insecticide application (to control thrips Regent @ 0.5ml/l of water was sprayed at 30, 40, 50 and 60 DAT)) + Fertilizer doses (cow dung 5 ton ha⁻¹, N₁₂₀, P₅₄, K₇₅ and S₂₀ kg ha⁻¹. On the other hand farmer's practice consist of seed sowing at last week of November in flat seed bed + seedling transplanting at 3rd week of January + Spacing (10cm × 7cm) + Irrigation (2-3 times) + Weeding (2times) + Fungicide application with Rovral, Score and other ineffective fungicides at 5-7 days interval + insecticide application with Confidor after thrips / insect appears + Fertilizer doses (N₄₆, P₄₅, K₃₀ and S₁₆ kg ha⁻¹. The different cultural practices are described below:

SRC recommended practice: In 2014-15 seeds were sown at 15 November and seedlings were transplanted to raised bed in the main field at 28 December, in 2015-16 seeds were sown at 03 November and seedlings were transplanted to raised bed in the main field at 20 December maintaining plant to plant spacing 10cm and line to line spacing 10cm. The fertilizers doses were cow dung 5 ton ha⁻¹, N₁₂₀, P₅₄, K₇₅ and S₂₀ kg ha⁻¹. The entire quantity of cow dung, P, K, S and half N were applied during land preparation. Remaining N was applied in two equal splits

at 25 and 50 days after transplanting.

Farmer's practice: In 2014-15 seeds were sown at 30 November and seedlings were transplanted at 18 January, in 2015-16 seed were sown at 22 November and seedlings were transplanted at 07 January in flat method maintaining line to line spacing 10 cm and plant to plant spacing 7 cm. The fertilizer doses were N₄₆, P₄₅, K₃₀ and S₁₆ kg ha⁻¹. **Raised bed:** The raised bed (10 cm height + 3 m length + 2 m width) was used to prepare the nursery of onion during the present study. In case of SRC practice, weeding was done at 25, 50 and 75 days after planting while only two weeding was done in farmer's practice Depending on maturity, in SRC practice the crop was harvested in 04 April, 2015 and 24 March, 2016 respectively. In farmer's practice crop was harvested in 13 April, 2015 and 02 April, 2016 respectively. However, the yield in 2015 was comparatively low due to attack of high temperature, rain-fall and storm immediately before harvest. Data on plant height (cm), leaves per plant, individual bulb weight (g), bulb length (mm), bulb breadth (mm) and bulb yield (t ha⁻¹) were recorded. The collected data were analyzed and mean values were adjusted by DMRT following MSTAT-C software (Gomez, 1984).

RESULTS AND DISCUSSION

The yield and yield contributing characters of onion as affected by planting methods and management practices are presented in Tables 3 and 4.

Spices research centre recommended practice: Spices Research Centre (SRC) recommended the production technology of onion, which include Bed type, seed sowing time, transplanting time, time and frequency of irrigation, plant protection system and other management practices. It had significant effect on yield and yield contributing characters of onion bulb production (Tables 3 and 4). The tallest plant (45.05cm in 2014-15 and 54.65 cm in 2015-16), individual bulb weight (23.58 g in 2014-15 and 20.46 g in 2015-16), bulb diameter (3.657 mm in 2014-15 and 3.657 mm in 2015-16) was obtained from Raised bed with SRC practice. The highest yield 14.42 t ha⁻¹ in 2014-15 and 12.57 t ha⁻¹ in 2015-16 was also recorded from SRC recommended practice.

Earlier researchers also established that sowing date has significant effect on most of the growth parameters of onion like plant height (Malik *et al.*, 1999), number of leaves plant⁻¹ (Hamma, 2013), foliage fresh weight (Kandil, 2013), number of flowering stalk, number of umbels plant⁻¹, number of capsule umbel⁻¹, number of seed capsule⁻¹ and seed yield umbel⁻¹ (Malik *et al.*, 1999, Jagtap *et al.*, 2014, Mehri *et al.*, 2015). On the contrary, Nayee *et al.* (2009) reported that, growth parameter like number of leaves plant⁻¹ does not influenced by planting date. In the case of early planting, plant gets enough time and comparatively higher temperature, which induces maximum vegetative growth (Rabinowitch, 1990; Ud-Deen, 2008; Hamma, 2013).

Farmers recommended practice: Farmers of Faridpur region have their own way to growing onion. They are used to growing onion in local method. Sowing time,

transplanting time and other management practices are not same as SRC recommended practices. So in 2014-15 and 2015-16 the shortest plant (34.67 cm and 47 cm), Individual bulb weight (16.85 g and 15.58 g) was obtained from Flat method+ Farmer's practice, respectively. The minimum number of leaves plant⁻¹ 4.80 in 2014-15 was found from Raised bed + Farmer's practice and 6 in 2015-16 from Flat method+ Farmer's practice. The lowest yield 8.05 t ha⁻¹ in 2014-15 and 7.66 t ha⁻¹ in 2015-16 was recorded from Flat method + Farmer's practice (Tables 3 and 4). Late planting often confine required photoperiod for vegetative growth and as the temperature increases, plants start bulb formation, which lead poor bulb yield (Misra et al., 2014).

Economic analysis: The economic performance of differ-

ent treatments is present in Tables 5 and 6. In 2014-15 the highest gross return (Tk. 937300 ha⁻¹) and net return (Tk. 850903.25 ha⁻¹) and benefit-cost ratio (10.85) from Raised bed + SRC recommended practice. Which was closely followed by Flat bed + SRC recommended practice.

The lowest gross return (Tk. 52357 ha⁻¹), net return (Tk. 445250.5 ha⁻¹) and benefit-cost ratio (6.68) were obtained from Flat bed + Farmers practice. In 2015-16 the highest gross return (Tk. 754200 ha⁻¹) and net return (Tk. 667803.5 ha⁻¹) and benefit-cost ratio (8.73) was obtained from Raised bed + SRC practice. Which was closely followed by Flat bed + SRC recommended practice. The lowest gross return (TK 459600 ha⁻¹), net return (Tk. 381275.5 ha⁻¹) and benefit-cost ratio (5.87) Flat bed + Farmers practice.

Table 1. Weather Data at Faridpur from July 2015 to April 2016.

Month	Temperature		Relative Humidity (%)	Total rainfall (mm)
	Max (°C)	Min (°C)		
July 2015	32.07	26.03	87.77	539.30
August 2015	32.68	26.73	86.90	312.20
September 2015	33.46	26.22	85.90	213.37
October 2015	32.92	23.89	81.00	79.4
November 2015	30.62	19.06	80.03	000.0
December 2015	25.93	15.15	81.51	006.0
January 2016	25.16	11.86	80.51	001.5
February 2016	30.06	17.78	75.24	15.8
March 2016	34.07	21.05	68.68	24.4
April 2016	36.11	26.23	74.50	57.2

Table 2. Month wise (July 2015 to June 2016) No. of rainfall days and range.

Month	Number of rainfall days	Range (mm)
July 2015	22	002.1-094.4
August 2015	22	000.2-84.6
September 2015	17	000.2-044.2
October 2015	08	000.6-052.6
November 2015	00	000.0-000.0
December 2015	02	000.8-005.2
January 2016	1	000.0-001.5
February 2016	3	002.6 - 010.0
March 2016	3	001.4 - 021.0
April 2016	3	7.8-33.00

Table 3. Effect of planting method on yield and yield contributing characters of onion bulb production during 2014-15.

Treatments	Plant height (cm)	Number of leaves	Individual bulb weight (g)	Bulb length (mm)	Bulb diameter (mm)	Yield (t ha ⁻¹)
Raised bed+ Farmer's practice	37.07 c	4.80 b	18.92 b	2.88	3.09 b	8.94 c
Raised bed+ SRC practice	45.05 a	6.68a	23.58 a	3.16	3.65 a	14.42a
Flat method+ Farmer's practice	34.67 c	5.30 b	16.85 c	2.99	2.91 b	8.05c
Flat method+ SRC practice	41.18 b	6.20 a	20.21 b	3.11	3.19 b	12.13 b
Level of sigf.	**	**	**	NS	**	**
CV (%)	5.06	7.57	5.83	11.07	6.93	14.26

NS= Non significant, **= 1% level of significant

Table 4. Effect of planting method on yield and yield contributing characters of onion bulb production during 2015-16.

Treatments	Plant height (cm)	Number of leaves	Individual bulb weight (g)	Bulb length (mm)	Bulb diameter (mm)	Yield (t ha ⁻¹)
Raised bed+Farmer's practice	47.87b	6.333Bc	17.58b	3.043a	3.440a	8.860bc
Raised bed+SRC practice	54.65a	7.083a	20.46a	3.247a	3.503a	12.57a
Flat method+ Faemer's practice	47.00b	6.000c	15.58c	3.040a	2.950b	7.667c
Flat method+ SRC practice	52.65a	6.533b	18.02b	3.155a	3.335a	10.12b
Level of signif.	**	**	**	NS	**	**
CV (%)	4.2	5.01	8.43	7.12	6.26	13.84

Table 5. Economic performance of different treatments on bulb production of onion during 2014-2015.

Treatment	Seed yield (t ha ⁻¹)	Gross return (Tk. ha ⁻¹)	Total cultivation cost (Tk. ha ⁻¹)	Net return (Tk. ha ⁻¹)	Benefit-cost ratio
Raised bed+ Farmers practice	8.948	581620	79100	502520	7.35
Raised bed + SRC practice	14.42	937300	86396	850903	10.85
Flat bed + Farmer practice	8.055	523575	78324	445250	6.68
Flat bed + Farmer practice	12.13	788450	85362	703087	9.24

Table 6. Economic performance of different treatments on bulb production of onion during 2015-2016.

Treatment	Seed yield (t ha ⁻¹)	Gross return (Tk. ha ⁻¹)	Total cultivation cost (Tk. ha ⁻¹)	Net return (Tk. ha ⁻¹)	Benefit-cost ratio
Raised bed + Farmers practice	8.86	531600	79100	452500	6.72
Raised bed + SRC practice	12.57	754200	86396.75	667803.25	8.73
Flat bed + Farmer practice	7.667	459600	78324.5	381275.5	5.87
Flat bed + Farmer practice	10.12	607200	85362.75	521837.25	7.11

Conclusions

From the above discussion it was evident that raised bed with SRC recommended practice showed better performance than the farmer's practice with flat method. The highest yield 14.42 t ha⁻¹ in 2014-15 and 12.57 t ha⁻¹ in 2015-16 was recorded from SRC recommended practice. So that the farmers of Faridpur region of Bangladesh are advised to adopt SRC recommended practice with raised bed method for increasing their annual average onion production.

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