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EFFECT OF DIFFERENT PLANTING DATES ON YIELD OF WINTER VEGETABLES IN *HAOR* AREA

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Abstract

The experiments were conducted in *haor* area under the Sunamganj district during the period from November 2018 to March 2019 to observe the effect of planting dates on the yield of three winter vegetables. Experiment included three planting dates viz. 5 November (P1), 15 November (P2), and 25 November (P3), on three vegetables viz. Tomato, Turnip, and Squash were designed in RCBD with three replications. Yield and yield contributing data were recorded. Different planting dates had significant variations for all vegetables. The highest yield of tomato (86.42 t ha^{-1}) was recorded on 5 November planting, and the lowest was 44.03 t ha^{-1} on 25 November planting. Gross return and net margin also secured the highest value in the first week of November with the highest BCR (5.38). In the case of turnip, similar trends were spotted. The highest gross yield was observed at 24.99 t ha^{-1} on 5 November planting, with the highest BCR (4.16). The lowest gross yield (22.77 t ha^{-1}) was obtained on 25 November planting with decreasing BCR (3.79). Squash also gave better production on 5 November planting (61.1 t ha^{-1}) with the highest gross return and net margin over other dates. The results revealed that the first week of November found a better time for winter vegetables (Tomato, Turnip, and Squash) cultivation in *haor* area after the recession of floodwater.

Keywords: Planting date, Yield, Winter vegetables, Gross return, BCR.

Introduction

The *haor* population suffers more from poverty, malnutrition, anemia, night blindness, poor growth and development of children, and micronutrient deficiency in comparison to plain land. Vegetables are considered one of the most important food crops due to their high nutritive value, relatively higher yield, and higher return (Sharmin, 2015). Homestead vegetable cultivation can provide adequate nutrition to the women farmers and their family members and generate income opportunities. Consuming diverse types of nutrient-dense vegetables regularly can help alleviate these problems. Especially production, yield, and area of winter vegetables in Bangladesh have experienced significant growth. Winter vegetables of Bangladesh are bottle gourd, tomato, turnip, carrot, cauliflower, cabbage, rabi brinjal, rabi pumpkin, radish, bean, green spinach, squash, potato etc. Production of these vegetables increased in the past decades because of increasing yield and farming areas. Moreover, vegetable farming is commercializing day by day all over the country. It enhanced the use of new variety and cultivation techniques. In addition, adaptation trial of new crops in new areas helps to increase vegetable yield as well. *Haor* is one of the special areas for vegetable production in Bangladesh. Boro rice is the only crop for that area. Vegetable cultivation is not common to the *haor* farmers in their practices. They thought that vegetable cultivation is time-consuming and less profitable rather than rice as well as fish catching. Considering the facts, initiatives were taken to practice vegetable cultivation around *haor* areas through farmers participatory approach so that farmers can be more assured on that. By implementing farming systems project, nowadays, the scenario is changing and farmers are more motivated to double cropping than single cropping. They are using their fallow land as well as their homestead area for vegetable cultivation. The floodwater recession is delayed subsequent years, the actual timing of vegetables is not similar to other areas. It is very important to observe which time prefers to which crops in *haor*.

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Therefore, three winter vegetables (tomato, turnip and squash) cultivation in different planting times were designed to perform as well as demonstrate. Tomato (*Lycopersicon esculentum*) is one of the most important winter vegetables of Bangladesh. It is a popular and nutritious vegetable rich in vitamin A and C as well as providing antioxidant elements such as lycopene which prevents cancer (Bhutani and Kallo, 1983). Tomato is a very popular vegetable due to its various uses like salad, curry purpose, jam, jelly, ketchup, pickles, soup, sauces, and preserved food items. It contains 1.90 g protein, 320 IU vitamin A, 1.8 mg iron, and 31 mg vitamin C per 100 g edible portion. Tomato favours cool and dry weather for their better growth and development (Rashid, 1993). In general, tomato cultivation is confined to the winter season i.e. November to February is considered to be the congenial time for tomato production. Optimum fruit setting requires a night temperature of 15 to 200C (Charles and Harris, 1972; Kuo et. al., 1979). The *Haor* area could be a special choice for winter tomato production. Turnip (*Brassica rapa L.*) is cultivated as root vegetable crop grown for its fleshy edible napi form roots (Langer and Hill, 1983) and belongs to the family Brassicaceae. Turnips are cool-weather vegetables that can be grown both in spring and fall, avoiding the hot summer months. They mature very rapidly and can be enjoyed both the greens and the roots. Turnip fresh roots are used as salad, cooked as vegetable, pickled and are rich source of minerals particularly calcium, Iron and vitamins viz., thiamine, riboflavin and ascorbic acid contents (Susan, 2010). Turnip roots have been found useful for its diuretic, laxative, digestive, anti-constipation, and resolvent properties. Squash (*Cucurbita pepo L.*) belongs to the family Cucurbitaceae and is grown throughout the world in both temperate and tropical climatic zones. In Bangladesh, this crop is relatively new but is increasingly gaining high levels of economic importance both in the generation of income and provision of nutritional value. Squash has various health benefits for human as well as medicinal potentials (Mohammad et al., 2011). It is rich in nutrients and bioactive compounds contents such as phenolics, flavonoids, vitamins (including β-carotene, vitamin A, vitamin B2, α-tocopherol, vitamin C, and vitamin E), amino acids, carbohydrates, and minerals (especially potassium), and it is low in energy content (about 17 Kcal/100 g of fresh squash) and has a large amount of fiber (Tamer et al., 2010). Squash is like cucumber, but its taste is different from other vegetables. In the meantime, squash marketing has started, and its market is much more in Dhaka with a high price. The farmers see hope in squash farming. Till today, squash is a high-value crop, and its demand is increasing due to its taste and nutritional value. Generally, squash is cultivated in our country during the winter season when rainfall is scanty, and its growth and development is required optimum temperature within 18-25 0C (Albert, 2018). Seeds may be sown from October to December, but mid-November is the best time for seed sowing (Rashid and Singh, 2000). After the recession of floodwater in *haor*, farmers are always waiting for rice cultivation in December, remaining their kanda land fellow. Production can be increased by bringing more kanda land under vegetable cultivation immediately after the recession of floodwater from *haor*. Sometimes flood water withstands up to November. There is no fixed date to flood water recession. Therefore, planting time is considered to be a key factor for the successful production of winter vegetables in *haor*. Appropriate planting date is also an important factor responsible for obtaining a higher yield. Considering the above mentioned facts, the present study was designed to observe the effects of different planting dates on the yield of winter vegetables in *haor* areas.

Materials and Methods

The experiment was conducted from November 2018 to March 2019 at *haor* village Noagaon, South Sunamganj Upazila of Sunamganj district. The soil of the experimental area is silt-loam in texture, having a pH of 4.9-5.2, and belongs to the Sylhet basin (AEZ 21). The experiment included three planting dates viz. 5 November (P1), 15 November (P2), and 25 November (P3), designed in a RCBD with three replications. The test varieties were Raja (tomato), Japanese hybrid variety for turnip and Sunny House (squash).

Tomato

Plot size for tomato crop was 5 m × 4 m with 60 cm × 40 cm plant spacing and applied fertilizers @ $N_{135}P_{45}$ K_{75} S_{15} Zn_2 B_1 kg ha^{-1} with cowdung @ 15 t ha^{-1}. Half of cow dung and the entire amount of TSP were applied during final land preparation. The pits were prepared one week before transplanting seedlings. The remaining cow dung and 1/3 of MoP were applied in pits during preparation. Topdressing was done in 3 equal installments at 15, 30, and 50 days after transplanting to apply the entire urea and rest 2/3 of MoP. Thirty days old seedlings were transplanted in the main field during above mentioned dates. Fruits were harvested plot-wise after attaining maturity. Yield and yield contributing data were recorded.

Turnip

The plot size for turnip crop was 5 m × 4 m with 25 cm × 25 cm plant spacing. Plots were applied with recommended fertilizers @ $N_{140}P_{45}K_{120}S_{24}Zn_3B_{1.2}$ kg $ha^{-1,}$ and thirty days old seedlings were transplanted to the main field on above mentioned dates. Nitrogen was applied in the form of urea. Half of the nitrogen was applied before transplanting and the remaining nitrogen was applied in two splits; one at the time of earthing up (30 days after planting) and the other at the time 50 DAP. Phosphorus and potassium were also applied as a basal dose before transplanting in the form of TSP and MoP, respectively. Turnip was harvested from January to February 2019. The yield and yield contributing characters were recorded.

Squash

Unit plot size of squash was 5 m × 4 m with 1 m × 1 m plant spacing. Fertilizers @ $N_{145}P_{48}K_{122}S_{20}Zn_3B_{1.4}$ were applied to the field, and seed sowing was done on above mentioned dates. The whole amount of TSP, Zn, and B were applied as basal during the final land preparation. Urea and MoP were applied in two equal splits at 30 and 50 DAS as a ring method under moist soil conditions and mixed thoroughly with the soil as soon as possible for better utilization. Harvesting was done at 2-3 days intervals during January 2019, and finally, yield was converted into t ha^{-1}.

The experimental fields were medium-high land with the well drained condition. Intercultural operations and irrigations were done as and when necessary. Crops were harvested when attaining harvesting maturity. So crops were not harvested at a time. After harvesting, yield data were recorded carefully. All data for the individual crop were analyzed for ANOVA using R software, and mean separation was calculated by DMRT (Gomez and Gomez, 1984). The total cost of production was calculated using simple statistical analysis. Gross return, net margin, and benefit-cost ratio (BCR) are also calculated.

Results & Discussion

Tomato

In the experiment, individual fruit weight (g), number of fruit plant-1, the weight of fruit $plant^{-1}$ (kg), and fruit yield (t ha^{-1}) of tomato were found statistically significant (Table 1). The results showed that the planting date on 5 November gave the heaviest individual fruit of 36.56 g, and the lightest fruit was observed on 25 November planting. The highest number of fruits was also recorded on 5 November planting, and the lowest number was counted on 25 November planting. Similar results were recorded in the case of the weight of fruit plant-1. The highest yield of 86.42 t ha-1 was recorded on 5 November planting, followed by 15 November planting (69.55 t ha^{-1}). These results were equivalent to Hossain (2004) in Bangladesh, who stated the highest tomato yield (86.40 t/ha) at early planting. The lowest yield of 44.03 t ha^{-1} was recorded on 25 November planting. Rogers and Wszelaki (2012) reported that early planted tomato yielded more marketable fruit during the production season than on later planting dates. Farmers' responses were highly positive towards tomato cultivation for their nutritional security.

Table 1: Effect of different planting dates on yield parameters of tomato in *haor* area

Treatments	Individual fruit weight (g)	No. of fruit $plant^{-1}$	Weight of fruit $plant^{-1}$ (kg)	Fruit yield (t ha^{-1})
5 November	36.56a	65.67a	2.47a	86.42a
15 November	30.19a	64ab	1.93a	69.55a
25 November	26.59b	46b	1.25b	44.03b
LS	*	*	*	*
CV(%)	5.7	14.68	41.04	41.37

"*"= Significant at 5%, LS = Level of significance and CV % = Co-efficient of variance

Economic analysis of Tomato

The cost of production of tomato with BCR was analyzed using a simple statistical procedure. The total cost for tomato production on different planting dates was Tk. 192683 (Table 2). The highest gross return was Tk. 1037040 on 5

November planting with the best BCR ratio (5.38) followed by 15 November planting. The gross return, as well as the net margin both, showed decreasing rate due to lower production on 25 November planting with the lowest BCR (2.74).

Table 2: Economic analysis of Tomato cultivation in *haor* area

Crop	Total cost of production (Tk.)	Gross return (Tk.)	Net margin (Tk.)	BCR
5 November	192683	1037040	844357	5.38
15 November		834600	641917	4.33
25 November		528360	335677	2.74

Tomato price@12 Tk. kg^{-1}

Turnip

Turnip diameter was statistically non-significant to planting dates but numerically decreased to advance planting dates. Similar behavioral trends were observed in Ali's experiments in 2020. The result showed that the heaviest fruit was 199.33 g observed on 5 November planting, while the lightest fruit was found on 25 November planting (164.33 g). Similar trends were followed in the case of gross weight individual fruit. Numerically the highest gross yield was of 24.99 t ha-1 with the highest fruit weight found on 5 November planting which was followed by 15 November planting (24.03 t ha^{-1}). The lowest gross yield (22.77 t ha^{-1}) was obtained due to 25 November planting (Table 3). Tiryakiolu and Mevlüt, (2012) stated that optimum planting resulted in higher yield, whereas delayed planting showed the opposite trends. The haor may be a suitable area for turnip production during the late season. According to Ali (2020), turnip yield was progressively increased due to early planting dates.

Table 3: Effect of different planting dates on yield of turnip in *haor* area

Treatments	Fruit diameter (cm)	Individual fruit weight (g)	Fruit yield (t ha^{-1})	Gross weight (g)	Gross yield (t ha^{-1})
5 November	25.67	199.33a	15.95	312.33	24.99
15 November	28.33	194.33a	15.55	300.67	24.03
25 November	28.67	164.33b	13.15	284.67	22.77
LS	NS	*	NS	NS	NS
CV%	5.48	13.42	13.42	20.15	20.18

"*"= Significant at 5%; NS = Not significant, LS = Level of significance and CV % = Co-efficient of variance

Economic analysis of Turnip

The cost of production analysis of turnip was calculated where the total cost of cultivation was Tk. 180417 (Table 4). Gross return and net margin were gradually falling down with planting dates. The highest return (Tk. 749700) was recorded on 5 November planting with the highest BCR (4.16), followed by 15 November planting. The lowest gross return (Tk. 683100) and net margin (Tk. 502683) were calculated from the last planting date (25 November). The BCR was 3.79 on 25 November planting.

Table 4: Economic analysis of Turnip cultivation in *haor* area

Crop	Total cost of production (Tk.)	Gross return (Tk.)	Net margin (Tk.)	BCR
5 November	180417	749700	569283	4.16
15 November		720900	540483	4.00
25 November		683100	502683	3.79

Turnip price@30 Tk. kg^{-1}

Squash

The number of fruits plant^{-1}, fruit circumstances (cm), and individual fruit weight (g) significantly differed along with yield. The number of fruits plant^{-1} was (7.73) the highest, recorded when sowing on 5 November and the lowest fruit number (3.97) was shown on 25 November sown. Fruit length and fruit circumstances were not statistically significant. But the longest fruit was found in the case of 5 November sowing and the shortest on 25 November. Fruit circumstances were 22.22 in the case of 5 November sown crop over 25 November (17.0). Statistically significant differences were found in the case of individual fruit weight and fruit yield. Fruit weight of 795.22 g was secured on 5 November sowing, followed by 15 November sowing, and 618.67 g was found on 25 November sowing. The highest yield of 61.1 t ha^{-1} was recorded on the 5 November sowing, and the lowest yield was 24.78 t ha^{-1} estimated on the 25 November sowing date. Khanum et al., 2021 agreed with similar results due to sowing dates (Table 5).

Table 5: Effect of sowing dates on yield attributes of squash in *haor* area

Sowing dates	Number of fruits plant^{-1}	Fruit length (cm)	Fruit circumstances (cm)	Individual fruit weight (g)	Fruit yield (t ha^{-1})
5 November	7.73a	35.94	22.22	795.22a	61.1a
15 November	5.4b	35.52	20.0	720.38ab	58.67ab
25 November	3.97b	35.66	17.0	618.67b	24.78b
LS	*	NS	NS	*	*
CV(%)	13.03	7.96	31.94	35.39	42.6

Economic analysis of Squash

The total cost of squash cultivation was Tk. 179718 (Table 6). The highest gross return was found with the highest BCR (10.2) when seeds were sown on 5 November, followed by 15 November. The lowest gross return (Tk. 743400) and net margin (Tk. 563682) were calculated on the 25 November sowing date with the lowest BCR (4.14).

Table 6: Economic analysis of Squash cultivation in *haor* area

Crop	Total cost of production (Tk.)	Gross return (Tk.)	Net margin (Tk.)	BCR
5 November	179718	1833000	1653282	10.20
15 November		1760100	1580382	9.80
25 November		743400	563682	4.14

Squash price@30 Tk. kg^{-1}

Conclusion

The results of the experiment revealed that winter vegetable production was very satisfactory on 15 November. The immediate recession of floodwater, seedlings can be planted up to the second week of November with satisfactory production.

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