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EFFECT OF PLANTING TIME AND FERTILIZER LEVELS ON GROWTH, YIELD AND ECONOMICS OF BETA-CAROTENE RICH BARI SWEET POTATO

M. R. H. MONDOL[1], M. Z. H. PRODHAN[2], M. T. RAHMAN[3]
M. M. ISLAM[4] AND M. B. ANWAR[5]

Abstract

The experiment was conducted at the Tuber Crops Research Sub-Centre, Bangladesh Agricultural Research Institute (BARI), Bogura, Bangladesh during rabi 2020-2021 to investigate growth, yield and profitability of the beta-carotene rich of sweet potato var. BARI Mistialu-12 as influenced by the date of plantings and fertilizer doses. The experiment consisted four levels of planting dates viz. D_1 = 30 October, D_2 = 10 November, D_3 = 20 November and D_4 = 30 November along with four levels of fertilizers viz. F_0 = control, F_1= 60-55-80 kg of NPK, F_2 = 80-75-100 kg of NPK and F_3= 100-95-20 kg of NPK fertilizer per hectare. The experiment was laid out in a spilt plot design with three replications assigning planting dates in the main plots and fertilizer doses in the sub-plots. The results indicated that among all treatment combinations planting on 20 November with 100-95-120 kg of NPK fertilizer per hectare performed better in considering length of tubers (13.57 cm), breadth of tubers (41.95 cm), number of tubers per plant (9.93), yield (46.99 t ha^{-1}), gross margin (Tk. 795,131/ha) and BCR (4.62). Marketable yield increased with the increasing of fertilizer doses.

Keywords: Sweet potato, planting time, fertilizer, growth and yield.

Introduction

Sweet potato is one of the important tuber crops in Bangladesh. It varies in flesh and skin colour, texture, leaf shape and vine length. It plays an important role in compensating the demand for cereals among the indigent people of Bangladesh. Tuber is the main usable part of the sweet potato, although leaves can also be used. It is consumed in several forms, with the tuber being consumed raw, boiled, as porridge or pounded into flour. The main nutritional material in sweet potato tubers are carbohydrates (starch 15-28% and sugars 3-6 %), protein, dietary fibre, fat and fat-soluble vitamins (Harvat *et al.,* 1991). Moreover, cultivars with a yellow and purple flesh also contain significant amounts of carotenes and anthocyanin (Maloney *et al.,* 2012 and Allen *et al.,* 2012). The area, total production and yield of sweet potato in Bangladesh have not changed much during the last decade. Factors that affect the quality of sweet potato are planting time, rate of fertilizer application, variety selection, mineral nutrients, plant population, water, soil moisture and rainfall, pest management, harvesting time, harvesting method,

[1]Senior Scientific Officer, [2]Principal Scientific Officer, [3]Senior Scientific Officer, Tuber Crops Research Sub-Centre, BARI, Bogura, [4]Scientific Officer, TCRC, BARI, Gazipur, [5]Scientific Officer, RARS, BARI, Jashore, Bangladesh.

spacing and storing (Amajor *et al*., 2011). Sweet potato production in Bangladesh is very low due to lack of high yielding modern varieties, lack of efficient cultivation technique and knowledge, lack of proper agronomic management practices as well as nutrient. Tropical soils are inherently low in nutrients particularly nitrogen and phosphorus (Haruna *et al*., 2013). So, the study aimed at identifying the most appropriate planting dates and fertilizer doses for optimum yield of beta-carotene rich sweet potato variety in Bogura condition.

Materials and Methods

The experiment was carried out at the Tuber Crops Research Sub-Center, Bangladesh Agricultural Research Institute (BARI), Bogura, Bangladesh during October 2020 to March 2021 to investigate growth and yield of the BARI Mistialu-12 as influenced by the date of plantings and fertilizer doses. The experimental site was located at 24.51^0 N latitude and 89.18^0 E longitudes which is 17 m above sea level. The experiment consisted four levels of planting dates viz. D_1 = 30 October, D_2 = 10 November, D_3 = 20 November and D_4 = 30 November along with four levels of fertilizers viz. F_0 =control, F_1=60-55-80 kg of NPK, F_2=80-75-100 kg of NPK and F_3= 100-95-20 kg of NPK per hectare. The experiment was laid out in a spilt -plot design with three replications assigning planting dates in the main plots and fertilizer doses in the sub-plots. Size of each unit plot was 3.0 m x 3.0 m. Beta-carotene rich sweet potato variety BARI Mistialu-12 was used as a test crop . The site is under the sub-tropical climatic zone characterized by relatively scanty rainfall, low humidity and low temperature, short day and long clear sunshine period during October to March. The meteorological data of the experimental site during crop period (October/ 2020-March/ 2021) are presented in Table 1

Table 1. The meteorological data of the experimental site during crop period (October-March).

Months	Mean temperature (^{0}C)	Relative Humidity (%)	Rainfall (mm)
	2020-2021	2020-2021	2020-2021
October	28.89	94.00	105
November	25.33	89.67	-
December	16.18	88.12	-
January	20.11	86.55	-
February	21.88	91.01	23
March	25.50	92.22	-

Source: Meteorological Department, Khander, Bogura.

The land type and soil of experimental area were medium high with sandy loam in texture, poorly drained, and developed on shallowly weathered soil having a pH in the ranges of 6.0 to 6.5 and belonging to the Barind Level Tract "AEZ 25" (UNDP

and FAO, 1988). The land was prepared with a power tiller by ploughing and cross ploughing followed by leveling with a ladder to obtain the desirable tilth. All the weeds, stubble and crop residues were removed from the experimental plot. The experimental plots were fertilized with blanket doses of cow dung = 10-ton, gypsum =80 kg, boric acid = 6 kg, zinc sulphate =10 kg per hectare. Half of urea and full dose of all fertilizers were applied immediately before final land preparation and mixed properly with the soil. The remaining amount of urea was applied as a side dressing at 30 days after planting. Irrigation, weeding, earthing up and other intercultural operations were done as and where necessary for raising a good crop. The crop was not sprayed through any pesticides to protect diseases and insects. The crop was harvested sequentially on 30 February, 10 March, 20 March and 30 March 2021. Data were recorded on different parameters as percent of ground coverage by vines, length of vines (cm), number of branch per plant, length of tubers (cm), breadth of tubers (cm), number of tubers per plant, marketable tuber yield (t ha^{-1}).

Statistical analysis

The recorded data were analyzed statistically following the computer package MSTAT-C and mean differences were evaluated by Duncan's Multiple Range Test (Gomez and Gomez, 1984).

Results and Discussion

Effect of planting time and fertilizers on growth parameters, yield contributing characters and yield of sweet potato

Percent of ground coverage of vines

The percent ground coverage of vines was significantly influenced by the date of planting (Table 2). The maximum percent of ground coverage (84.11%) was recorded from 30 October planting, while the lowest in 30 November planting (71.25%). It might be due to sweet potato plants planted on 30 October (D_1) received more rainfall than other three dates which promotes more vegetative growth of the crop. These results agree with the findings of Amajor *et al.* (2011) and Martin (1987). Ground coverage of vines was significantly influenced by fertilizers (Table 3). The maximum percent of ground coverage (90.41%) was recorded from 100-95-120 kg of NPK fertilizer per hectare, while the lowest in control plot (51.25%). Here, it is observed that vine ground coverage is increasing with increasing fertilizer doses. It might be due to effect of nitrogen, phosphorus and potassium which are essential for the growth of all the plants and needed to restore soil fertility. Ground coverage of vines showed significant variation in combined effect (Table 4).The highest percentage of ground coverage (95.00%) was obtained from 20 November planting and 100-95-120 kg of NPK fertilizer per hectare, while the lowest (51.45%) was obtained from 30 October with the control plot.

Length of vines

The date of planting had a significant influence on vine length (Table 2). The maximum length of vines (66.32 cm) was recorded from 30 October planting, while the lowest in 30 November planting (57.05 cm). The result revealed that the vine length decreased gradually with the delay in planting dates. It might be due to congenial weather conditions, a favorable soil temperature and moisture. The result is supported by Alloli *et al.* (2011). Length of vines was significantly influenced by fertilizers (Table 3). The maximum length of vines (64.99 cm) was recorded for 100-95-120 kg of NPK fertilizer per hectare which was similar to 80-75-100 kg of NPK fertilizer per hectare (63.10 cm), while the lowest in control plot (54.81cm). The differences in length of vine could be attributed to fertilizer rate on the plants. This result is in total agreement with the findings reported by Satapathy *et al.* (2005) and Mitra (2012) who noted that a high rate of fertilizer application encourages vine growth rather than storage root development. The length of vines showed significant variation in combined effect (Table 4).The longest vines (75.10 cm) were found on 30 October planting and 100-95-120 kg of NPK fertilizer per hectare, while the shortest (47.07 cm) on 30 November and the control plot.

Length of tubers

The length of tubers was significantly influenced by date of planting (Table 2).The maximum length of tubers (13.04 cm) was recorded from 20 November planting, while the lowest in 30 October planting (10.10 cm). It might be due to favourable climatic condition, soil and atmospheric temperature during 20 November planting. On the other hand, in October the soil and atmospheric temperatures were higher, and this affected the growth and development of sweet potato. This finding was supported by Alloli *et al.* (2011) and Yenagi *et al.* (2004). The length of tubers was significantly influenced by fertilizers (Table 3). The maximum length of tubers (13.45 cm) was recorded from 100-95-120 kg of NPK fertilizer per ha, while the lowest in control plot (11.38 cm). Here, observed that length of tuber increases with the increases apply of fertilizers. . It could be because of the increased nutrient use efficiency from chemical fertilizers. These results agree with the findings of Asghar *et al.* (2006) and O' Sullivan (1997). The length of tubers showed significant variation in combined effect (Table 4). The maximum length of tubers (13.57 cm) was recorded from 20 November planting and 100-95-120 kg of NPK fertilizer per hectare which was statistically identical to 20 November

planting and 80-75-100 kg of NPK fertilizer per hectare (13.07 cm), 20 November planting and 60-55-80 kg of NPK fertilizer per hectare(12.84 cm), 10 November planting and 100-95-120 kg of NPK fertilizer per hectare(13.07 cm) and 30 October planting and 100-95-120 kg of NPK fertilizer per hectare(13.00 cm), while the lowest in 30 October planting and control plot (9.73 cm).

Breadth of tubers

The breadth of tubers was significantly influenced by date of planting (Table 2).The maximum breadth of tubers (37.02 cm) was recorded from 20 November planting, while the lowest in 30 October planting (25.90 cm). The breadth of tubers differed with the planting dates due to the variation of temperature, rainfall, sunlight etc. during the growth period. It might be due to the variation of weather condition and other environmental effects. These results agree with the findings of Ghosh *et al.* (2008). Breadth of tubers was significantly influenced by fertilizers (Table 3).The maximum breadth of tubers (35.49 cm) was recorded from 100-95-120 kg of NPK fertilizer per hectare, while the lowest in control plot (33.81 cm). It might be due to good root extension, bulking capacity of soil and increased fertilizer doses. These results agree with the findings of (Adhikari, 2009). Breadth of tubers showed significant variation in combined effect (Table 4).The maximum tuber breadth (41.95 cm) was obtained from the 20 November planting and 100-95-120 kg of NPK fertilizer per hectare, while the lowest (21.69 cm) from the 30 October planting and control plot.

Number of tubers per plant

Number of tubers per plant was significantly influenced by date of planting (Table 2).The highest number of tubers per plant (9.05) were produced from 20 November planting, while the lowest from 30 October planting (5.93). It might be due to favourable climatic condition, soil and atmospheric temperature during 20 November planting. On the other hand, in October the soil and atmospheric temperatures were higher, and the waterlogged condition of the soil due to caused by heavy rainfall resulted in poor growth of storage root. This finding was supported by Fredrick *et al.* (1996); Alloli *et al.* (2011) and Yenagi *et al.* (2004). Number of tubers per plant was significantly influenced by fertilizers (Table 2). The maximum number of tubers per plant (8.13) were produced from 100-95-120 kg of NPK fertilizer per hectare, which was similar with 80-75-100 kg of NPK fertilizer per ha (7.91) and 60-55-80 kg of NPK fertilizer per hectare (7.82 cm), while the lowest produced from control plot (6.55). It might be due to the effect of NPK. The nutrients which greatly affect potato productivity are the elements N, P and K. It was reported by Damari *et al.* (2015). The number of tubers per plant showed significant variation in combined effect (Table 4). The maximum number of tubers per plant (9.93) were produced from 20 November planting and100-95-120 kg of NPK fertilizer per hectare, which was statistically identical to 20 November planting and 80-75-100 kg of NPK fertilizer per hectare (9.55) and 20 November planting and 60-55-80 kg of NPK fertilizer per hectare (9.33), while the lowest from 30 October planting and control plot (5.20).

Marketable tuber yield

Marketable tuber yield was significantly influenced by date of planting (Table 2).The highest marketable tuber yield (38.04 t ha^{-1}) was obtained from 20 November planting, while the lowest in 10 November planting (22.3 t ha^{-1}). This might be due to the growth period passing through favorable temperatures, relative humidity and good moisture conditions on 20 November, which improve the yield of sweet potato. The similar findings were also recorded by Kushwah *et al.* (2011) and Alloli *et al.* (2011) in sweet potato. Marketable tuber yield was significantly influenced by fertilizers (Table 3). The highest (35.52 t ha^{-1}) was obtained from 100-95-120 kg of NPK fertilizer per hectare, while the lowest in control plot (21.14 t ha^{-1}). It might be due to effect of NPK. The nutrients that greatly affect potato productivity are the elements N, P and K (Damari *et al.*, 2015). Marketable tuber yield showed significant variation in combined effect (Table 4).The highest marketable tuber yield (46.99 t ha^{-1}) was obtained from 20 November planting and 100-95-120 kg NPK fertilizer per hectare, while the lowest yield (15.04 t ha^{-1}) from 30 October planting and the control plot.

Table 2. Effect of date of planting on plant growth, yield contributing characters and yield of sweet potato var. BARI Mistialu-12

Date of sowing	Ground coverage of vines(%)	Length of vines(cm)	Branch per plant (no)	Length of tubers (cm)	Breadth of tubers (cm)	Tubers per plant(no)	Marketable tuber yield (t ha^{-1})
D_1 = 30 October	84.11a	66.32a	3.57	10.10c	25.90c	5.93c	23.38c
D_2 = 10 November	75.00c	58.41c	3.00	12.30b	36.22b	6.33b	22.34c
D_3 = 20 November	81.25b	63.33b	2.30	13.04a	37.02a	9.05a	38.04a
D_4 = 30 November	71.25d	57.05d	2.20	12.31b	36.42b	7.43b	31.88b
LSD (0.05)	2.30	1.25	NS	0.56	0.66	1.56	3.67
CV (%)	3.21	2.58	2.87	2.03	1.85	2.65	2.90

Table 3. Effect of fertilizers on plant growth, yield contributing characters and yield of sweet potato var. of BARI Mistialu-12

Fertilizer doses	Ground coverage (%)	Length of vines (cm)	Branch Per plant (no.)	Length of tubers (cm)	Breadth of tubers (cm)	Tubers per plant (no.)	Marketable yield (t ha^{-1})
F_0 =control	56.19d	54.81c	2.51	11.38c	33.81c	6.55b	21.14d
F_1= 60-55-80 kg NPK/ha	80.00c	62.21b	2.85	11.91b	32.24d	7.82ab	28.19c
F_2 = 80-75-100 kg NPK/ha	85.00b	63.10ab	2.90	12.17b	34.03b	7.91ab	30.81b
F_3= 100:95:120 kg NPK/ha	90.41a	64.99a	2.80	13.45a	35.49a	8.13a	35.52a
LSD (0.05)	3.33	2.01	NS	1.54	0.99	1.00	2.23
CV (%)	8.42	7.74	2.95	5.43	3.53	4.83	8.79

Table 4. Interaction effect of planting dates and fertilizer doses on plant growth, yield contributing characters and yield of Sweet potato var. BARI Mistialu-12.

Planting dates and fertilizer doses	Ground coverage (%)	Length of vines (cm)	Branch per plant (no)	Length of tubers (cm)	Breadth of tubers(cm)	Tubers per plant(no)	Marketable tuber yield (t ha^{-1})
D_1xF_0	71.45e	61.80c	3.33	9.73d	21.69d	5.20c	15.04e
D_1xF_1	90.00b	65.53bc	3.73	10.40c	28.51cd	6.73bc	20.10d
D_1xF_2	86.67cd	62.87c	3.90	10.60c	31.36cd	6.20bc	25.30c
D_1xF_3	88.33bc	75.10a	3.33	9.67e	22.04d	7.20bc	33.12bc
D_2xF_0	51.67g	50.93d	2.87	11.67bc	34.55bc	4.93d	17.26de
D_2xF_1	78.33cde	58.93cde	3.07	12.00b	33.03c	6.40bc	22.75d
D_2xF_2	80.00cde	62.93c	2.93	12.50b	35.38bc	6.47bc	24.36cd
D_2xF_3	90.00b	60.87cd	3.13	13.07a	34.19bc	5.93c	25.01c
D_3xF_0	51.67g	59.47d	2.00	12.68b	35.47bc	7.40bc	28.65c
D_3xF_1	86.67cd	65.27bc	2.40	12.84ab	38.00b	9.33a	35.06bc
D_3xF_2	91.67b	68.13b	2.40	13.07a	38.03b	9.55a	41.49b
D_3xF_3	95.00a	60.47cd	2.40	13.57a	41.95a	9.93a	46.99a
D_4xF_0	50.00g	47.07f	1.87	11.47bc	36.72bc	7.07bc	23.61cd
D_4xF_1	65.00f	59.13d	2.20	12.40b	36.23bc	7.40bc	34.85bc
D_4xF_2	81.67cde	58.47cde	2.40	13.00a	37.19b	8.00b	32.09bc
D_4xF_3	88.33bc	63.53c	2.33	12.40b	37.95b	7.27bc	36.98bc
LSD	3.24	2.72	NS	0.75	1.20	1.11	4.56
CV (%)	8.42	7.74	2.95	5.43	3.53	4.83	8.79

Mean values in a column having the same letters do not differ significantly while those with dissimilar letters differ significantly as per DMRT.

N.B.: D_1 = 30 October, D_2 = 10 November, D_3 = 20 November, D_4 = 30 November

F_0 = control, F_1= 60-55-80 kg of NPK/ha, F_2 = 80-75-100 kg of NPK/ha, F_3= 100:95:120 kg of NPK/ha

Economic Analysis

According to cost and return analysis, among all interaction of planting time and fertilizers, the highest gross margin (Tk. 795,131/ha) and BCR (4.62) were estimated from 20 November planting and 100:95:120 kg of NPK fertilizer per hectare (Table 7), while the lowest were gross margin (Tk. 163,416/ha) and BCR (1.05) was estimated from 30 October planting and control plot.

Table 5. Comparative agro-economic performance of Sweet potato var. BARI Mistialu-12 under interaction of planting date and fertilizer doses

Interaction (planting date and fertilizer doses)	Yield (t ha^{-1})		Total variable cost (Taka ha^{-1})	Gross return (Taka ha^{-1})	Gross margin (Taka ha^{-1})	BCR
	Tuber	Green Stover				
D_1xF_0	15.04	8.88	155144/-	318,560/-	163,416/-	1.05
D_1xF_1	20.10	10.00	165299/-	422,000/-	256,701/-	1.55
D_1xF_2	25.30	11.11	172069/-	528,220/-	356,151/-	2.06
D_1xF_3	33.12	13.33	168653/-	689,060/-	520,407/-	3.08
D_2xF_0	17.26	8.50	155144/-	362,200/-	207,056/-	1.33
D_2xF_1	22.75	10.25	165299/-	475,500/-	310,201/-	1.87
D_2xF_2	24.36	11.33	168653/-	509,860/-	341,207/-	2.02
D_2xF_3	25.01	13.40	172069/-	527,000/-	354,931/-	2.06
D_3xF_0	28.65	8.35	155144/-	589,700/-	434,556/-	2.80
D_3xF_1	35.06	10.32	165299/-	721,840/-	556541/-	3.36
D_3xF_2	41.49	11.61	168653/-	853,020/-	684,367/-	4.05
D_3xF_3	46.99	13.70	172069/-	967,200/-	795,131/-	4.62
D_4xF_0	23.61	8.20	155144/-	488,600/-	333,456/-	2.14
D_4xF_1	34.85	10.12	165299/-	697,000/- 717,240/-	551,941/-	3.33
$D_4 \times F_2$	32.09	11.26	168653/-	664,320/-	495,667/-	2.93
$D_4 \times F_3$	36.98	13.14	172069/-	765,880/-	593,811/-	3.45

N.B.: Urea = Tk. 16.00 /kg, TSP = Tk. 22.00 /kg, MOP = Tk. 15.00 /kg, Boric acid = Tk. 160 /Kg, Gypsum =Tk. 10.00 /kg, Manures =Tk. 1.00 /kg, Labour = Tk. 450.00/ 8 hr /head, Irrigation = Tk. 8000 /ha, Ploughing = Tk 1500/plough/ha, Potato= TK.20 /kg, Vine = Tk. 1.00 /kg

Conclusion

From the above results, it may be concluded that Sweet potato var. BARI Mistialu-12 planted on 20 November with 100-95-120 kg of NPK fertilizer per hectare found optimum in considering length of tubers (13.57 cm), breadth of tubers (41.95 cm), number of tubers per plant (9.93), yield (46.99 t ha^{-1}), gross margin (Tk. Table 4). Interaction effect of planting dates and fertilizer doses on plant growth, yield contributing characters and yield of BARI Mistialu-12.

Interaction (planting dates and fertilizer doses)	Ground coverage (%)	Length of vines (cm)	Branch per plant (no)	Length of tubers (cm)	Breadth of tubers(cm)	Tubers per plant(no)	Marketable tuber yield (t ha^{-1})
D_1xF_0	71.45e	61.80c	3.33	9.73d	21.69d	5.20c	15.04e
D_1xF_1	90.00b	65.53bc	3.73	10.40c	28.51cd	6.73bc	20.10d
D_1xF_2	86.67cd	62.87c	3.90	10.60c	31.36cd	6.20bc	25.30c
D_1xF_3	88.33bc	75.10a	3.33	9.67e	22.04d	7.20bc	33.12bc
D_2xF_0	51.67g	50.93d	2.87	11.67bc	34.55bc	4.93d	17.26de
D_2xF_1	78.33cde	58.93cde	3.07	12.00b	33.03c	6.40bc	22.75d
D_2xF_2	80.00cde	62.93c	2.93	12.50b	35.38bc	6.47bc	24.36cd
D_2xF_3	90.00b	60.87cd	3.13	13.07a	34.19bc	5.93c	25.01c
D_3xF_0	51.67g	59.47d	2.00	12.68b	35.47bc	7.40bc	28.65c
D_3xF_1	86.67cd	65.27bc	2.40	12.84ab	38.00b	9.33a	35.06bc
D_3xF_2	91.67b	68.13b	2.40	13.07a	38.03b	9.55a	41.49b
D_3xF_3	95.00a	60.47cd	2.40	13.57a	41.95a	9.93a	46.99a
D_4xF_0	50.00g	47.07f	1.87	11.47bc	36.72bc	7.07bc	23.61cd
D_4xF_1	65.00f	59.13d	2.20	12.40b	36.23bc	7.40bc	34.85bc
D_4xF_2	81.67cde	58.47cde	2.40	13.00a	37.19b	8.00b	32.09bc
D_4xF_3	88.33bc	63.53c	2.33	12.40b	37.95b	7.27bc	36.98bc
LSD	3.24	2.72	NS	0.75	1.20	1.11	4.56
CV (%)	8.42	7.74	2.95	5.43	3.53	4.83	8.79

Mean values in a column having the same letters do not differ significantly while those with dissimilarletters differ significantly as per DMRT.

N.B.: D_1 = 30 October, D_2 = 10 November, D_3 = 20 November, D_4 = 30 November

F_0 = control, F_1= 60-55-80 kg of NPK/ha, F_2 = 80-75-100 kg of NPK/ha, F_3= 100:95:120 kg of NPK/ha

Table 4. Interaction effect of planting dates and fertilizer doses on plant growth, yield contributing characters and yield of sweet potato var. BARI Mistialu-12.

Interaction (planting dates and fertilizer doses)	Ground coverage (%)	Length of vines (cm)	Branch per plant (no)	Length of tubers (cm)	Breadth of tubers(cm)	Tubers per plant(no)	Marketable tuber yield (t ha^{-1})
D_1xF_0	71.45e	61.80c	3.33	9.73d	21.69d	5.20c	15.04e
D_1xF_1	90.00b	65.53bc	3.73	10.40c	28.51cd	6.73bc	20.10d
D_1xF_2	86.67cd	62.87c	3.90	10.60c	31.36cd	6.20bc	25.30c
D_1xF_3	88.33bc	75.10a	3.33	9.67e	22.04d	7.20bc	33.12bc
D_2xF_0	51.67g	50.93d	2.87	11.67bc	34.55bc	4.93d	17.26de
D_2xF_1	78.33cde	58.93cde	3.07	12.00b	33.03c	6.40bc	22.75d
D_2xF_2	80.00cde	62.93c	2.93	12.50b	35.38bc	6.47bc	24.36cd
D_2xF_3	90.00b	60.87cd	3.13	13.07a	34.19bc	5.93c	25.01c
D_3xF_0	51.67g	59.47d	2.00	12.68b	35.47bc	7.40bc	28.65c
D_3xF_1	86.67cd	65.27bc	2.40	12.84ab	38.00b	9.33a	35.06bc
D_3xF_2	91.67b	68.13b	2.40	13.07a	38.03b	9.55a	41.49b
D_3xF_3	95.00a	60.47cd	2.40	13.57a	41.95a	9.93a	46.99a
D_4xF_0	50.00g	47.07f	1.87	11.47bc	36.72bc	7.07bc	23.61cd
D_4xF_1	65.00f	59.13d	2.20	12.40b	36.23bc	7.40bc	34.85bc
D_4xF_2	81.67cde	58.47cde	2.40	13.00a	37.19b	8.00b	32.09bc
D_4xF_3	88.33bc	63.53c	2.33	12.40b	37.95b	7.27bc	36.98bc
LSD	3.24	2.72	NS	0.75	1.20	1.11	4.56
CV (%)	8.42	7.74	2.95	5.43	3.53	4.83	8.79

Mean values in a column having the same letters do not differ significantly while those with dissimilarletters differ significantly as per DMRT.

N.B.: D_1 = 30 October, D_2 = 10 November, D_3 = 20 November, D_4 = 30 November

F_0 = control, F_1= 60-55-80 kg of NPK/ha, F_2 = 80-75-100 kg of NPK/ha, F_3= 100:95:120 kg of NPK/ha 795,131/ha) and BCR (4.62) for sweet potato cultivation in Bogura region.

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