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Effect of Seed Size and Cutting Methods on the Yield and Profitability of Potato

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Abstract

An experiment was conducted at the research field of Tuber Crop Research Centre (TCRC) of Bangladesh Agricultural Research Institute, Gazipur during the winter of 2006-2007 to determine the effects of cutting methods and seed size on the yield and profitability in potato (*Solanum tuberosum* L.). It was observed that the foliage coverage, plant height, stems/hill, number and weight of tubers/plant varied significantly due to variation of tuber size. The highest germination index (18.13) was found when large size whole tuber was used followed by small size whole tuber and medium size whole tuber. Vigorous plants, maximum plant height and the number of stems/ hill at 60 DAP were also produced when the crop was raised from large size whole tubers. The maximum leaf area of 3909 cm^2 was found in medium size –half proximal treatment. The highest number (10.23) and weight of tubers/ hill (0.40 kg) were observed in T_6 large size-whole tuber treatment. The highest gross yield of tubers (25.10 t/ha) was also produced when large whole tubers were used. However, small tuber size and half cut distal would be economically profitable for enhancing growth and yield of potato.

Keywords: **Potato, seed size, cutting methods, profitability**

1. Introduction

The average yield of potato (*Solanum tuberosum*) is about 14.76 t/ha in Bangladesh which is very low compared to the other leading potato growing countries like Belgium, New Zealand, the Netherlands and United Kingdom (Chadla *et al.*, 2001). Now it occupies the second place in acreage and production after rice (Anonymous, 2010). The potential yield of the crop is much higher than the average yield. Among the many causes of low yield of potato, lack of improved production technologies is very important. Seed quality, seed size, seed cutting, plant spacing etc. are some of the management practices which should be standardized for each agro-climatic zones of the country. At present, the seed supply from recognizable sources is about 19,000 metric tons. Out of the total requirement, BADC is supplying only about 2% that is used by the farmers as the replacement stock (Talukder, 2004). The cost of seed, or in other words the seed rate is directly associated with the size of seed and plant spacing. On the other hand, the yield of potato is influenced by the size of seed. In general larger seed and closer planting up to a certain limit increase the yield of tubers per unit area. Khurana *et al.* (1994) suggested that for a given seed tuber size, total tuber yield increased with increase in tuber rate. For a given seed tuber rate (2.5 t/ha), total seed tuber yield decreased with increase in seed tuber size. The cost of seed potato is very high and it constitutes from 25 to 50% of the total cost of production in Bangladesh. For reducing the seed

cost farmers of many potato-growing areas are using cut tubers with closer spacing although TCRC recommended whole tuber with 60 cm X 25 cm spacing. However, seed cost remains more or less same as the cost of using whole tuber at wider spacing, since the farmers use closer spacing for cut seed. Many researchers also found better yield by using cut seed with closer spacing (Bushan, 2007; Zebarth, 2006; Garba, 2005; Shaha, 2004; Hoque, 2001; Nandekar *et al.*, 1993; Banarjee *et al.*, 1988). In case of cut tuber, spacing should be the same as recommended for whole tuber to reduce the seed cost. In this context, an investigation was undertaken to find out proper combination of seed size and cutting methods for profitable potato production

2. Materials and Methods

The investigation was carried out at the research field of Tuber Crops Research Centre (TCRC) of Bangladesh Agricultural Research Institute (BARI), Gazipur during winter, 2006-2007. All sizes of tubers were cut longitudinally to obtain longitudinal half cut. Longitudinal half cut pieces were cut again for getting $1/4^{th}$ longitudinal cut. All sizes of tubers were cut horizontally (cross wise) to obtain half distal and half proximal cut pieces. Half distal and half proximal cut pieces were cut into half for obtaining $1/4^{th}$ crosswise cut pieces. Thus, longitudinal half cut, $1/4^{th}$ longitudinal cut, distal half cut, proximal half cut and $1/4^{th}$ cut crosswise pieces of all sizes tubers were obtained. Seed size 'S' (Large-S_1=45-55 g, Medium-S_2=35-45 g, Small-S_3=25-35 g and cutting methods **'**C' (Half longitudinal-C_1, Half distal-C_2, Half proximal-C_3, $1/4^{th}$ crosswise-C_4, $1/4^{th}$ longitudinal-C_5, Whole tuber-C_6) were the two factors. The three sizes of seed tubers and six cutting methods made 18 treatments**.** The treatments were designated as $T_1=S_1C_1$=Large size-Half longitudinal,$T_2=S_1C_2$=Large size-Half distal,$T_3=S_1C_3$=Large size-Half proximal, $T_4=S_1C_4$= Large size- $1/4^{th}$ crosswise, $T_5=S_1C_5$ =Large size-$1/4^{th}$ longitudinal, $T_6=S_1C_6$=Large size-Whole tuber, $T_7=S_2C_1$=Medium size-Half longitudinal, $T_8=S_2C_2$=Medium size-Half distal, $T_9=S_2C_3$= Medium size- Half proximal, $T_{10}=S_2C_4$= Medium size- $1/4^{th}$ crosswise, $T_{11}=S_2C_5$= Medium size- $1/4^{th}$ longitudinal, $T_{12}=S_2C_6$=Medium size-Whole tuber, $T_{13}=S_3C_1$= Small size-Half longitudinal, $T_{14}=S_3C_2$=Small size-Half distal, $T_{15}=S_3C_3$=Small size-Half proximal, $T_{16}=S_3C_4$=Small size-$1/4^{th}$ crosswise, $T_{17}=S_3C_5$=Small size-$1/4^{th}$ longitudinal, $T_{18}=S_3C_6$=Small size-Whole tuber. The experiment was laid out in a randomized complete block design (RCBD) with three replications.

The seed tubers were planted in 3m x 3m plots on 28^{th} November 2006 maintaining a spacing of 60 cm x 25 cm. Thus each unit plot accommodated 60 pieces (whole or cut) in 5 rows. The depth of planting was 10cm from the surface of the soil. Data were recorded on germination index, plant height, plant vigor (1-10 score), foliage coverage, no. of stems / hill, area of leaf (cm^2), no. of tubers / hill, wt. of tubers / hill, yield of tubers per plot, yield of tubers / hectare, tuber grade by number, tuber grade by weight.

Data on different parameters were analyzed statistically using MSTAT-C program to find out the significance of experimental result. Partial economic analysis was done in order to find out comparative benefits of the combination treatments of seed size and cutting methods. For this purpose cost for seed cutting, fertilizer / pesticides application and harvesting of tubers were recorded for unit plot and then converted into cost per hectare. Partial analysis was done calculating non-material (labour) and material (seed) input costs for computing the cost of production. The price of the potato tubers was determined on market price basis. At harvest it was considered to be Tk.7.00, 12.00, 17.00, 16.00 and 15.00 for tuber grade <20mm (under size), 20-28mm (under size), 28-40mm (A grade), 40-55mm (B grade) and >55mm (over size), respectively (Table 5). Less than 20 mm and 20-28 mm size are considered as non seed in consideration of seed grade and less than 20 mm size tuber is considered as non-marketable seed

potato. So, their price was minimum for under sized seed potato and maximum in seed sized potato (A and B) in the harvesting season.

3. Results and Discussion

3.1. Morphological characters and yield

The data on morphological characters and yield are presented in Tables 1, 2 and 3. The effect of seed size and cutting methods on all the characters under study varied significantly. Maximum germination index (18.13) was observed in T_6, while the lowest (8.71) was in T_{17}. Plant vigor scored to be the highest in T_6 at 30, 45 and 60 days after planting, while the minimum (3.33) was in T_{16} and T_{17}. Effect of seed size and cutting methods on foliage development was increased with the progress in DAP. Highest foliage coverage (85.67 %) was produced by T_6 (large whole tuber) followed by T_{12}, T_8, T_2, T_{18} and T_{14}, while the lowest (16.67%) was in T_{17} (small 1/4th cut longitudinal) (Table 1). The highest foliage coverage in the treatment T_6 at 60 DAP might be due to more number of stems produced from the whole tuber that possessed more eyes. During the period of plant growth the maximum plant height was recorded from the treatment T_6 (43.40 cm) followed by T_{12} (36.20cm) while the minimum from T_{11} (22.87cm). Similar trend of plant height was also observed at 30 and 45 DAP.

Table 1. Effect of seed size and cutting methods on germination index, plant vigour and foliage coverage

Treatment	Germination index	Plant vigor (1-10)			Foliage coverage (%)		
		30 DAP	45 DAP	60 DAP	30 DAP	45DAP	60 DAP
T_1= S_1C_1	15.35bc	4.67e	5.00de	5.00de	30.00de	41.67 de	46.67d
T_2= S_1C_2	15.97bc	6.67bc	6.67c	7.33b	53.33bc	61.67bc	66.67bc
T_3= S_1C_3	12.97de	3.67e-h	4.00fg	5.00de	25.00 ef	31.67fg	35.00ef
T_4= S_1C_4	12.48e	4.67de	5.67d	6.00cd	30.00de	38.33def	41.67de
T_5= S_1C_5	12.38e	3.67e-h	4.33ef	4.67de	31.67de	35.00ef	43.33de
T_6= S_1C_6	18.13a	8.00a	8.67a	9.00a	71.67a	83.33a	85.67a
T_7= S_2C_1	14.62cd	4.33ef	5.33d	6.00cd	35.00d	41.67 de	48.33d
T_8= S_2C_2	14.23cde	7.67ab	7.67b	7.67b	56.67bc	61.67bc	66.67bc
T_9= S_2C_3	13.30de	4.00efg	5.67 d	6.00cd	35.00d	41.67 de	43.33de
T_{10}=S_2C_4	10.65f	3.00ghi	3.67 fg	4.00 ef	21.67fg	26.67gh	26.67fg
T_{11}=S_2C_5	8.98fg	2.00i	2.67h	3.00f	14.00h	18.33ij	18.33g
T_{12}=S_2C_6	16.67ab	7.00ab	7.00 bc	7.67b	60.00b	66.67b	73.33b
T_{13}=S_3C_1	14.73cd	5.67cd	5.67d	5.67d	36.67d	43.33d	45.00de
T_{14}=S_3C_2	15.53bc	6.67bc	6.67c	7.00bc	50.00c	55.00c	61.67c
T_{15}=S_3C_3	15.33bc	3.67e-h	4.33 ef	5.33d	31.67de	36.67def	43.33de
T_{16}=S_3C_4	10.40fg	2.67hi	3.33gh	3.33f	16.67gh	21.67hi	21.67g
T_{17}=S_3C_5	8.72g	3.33fgh	3.33gh	3.33f	13.33h	13.33j	16.67g
T_{18}=S_3C_6	17.13ab	6.67bc	6.67 c	7.00bc	56.67bc	60.00 bc	63.33bc
CV%	7.45	11.75	9.77	12.19	11.00	9.62	12.71
Level of significanc	**	*	*	*	*	*	*

* & ** indicate significance at 5% & 1% level of probability, DAP= Days after planting. Means in a column followed by the same letters do not differ significantly at 1% level of significance. 'S' and 'C' indicate seed size (large-S_1, medium-S_2, and small-S_3) and cutting methods (half longitudinal-C_1, half distal-C_2, half proximal-C_3, 1/4th crosswise-C_4, 1/4th longitudinal-C_5, whole tuber-C_6), respectively

The maximum number of stems was found in T_6 (8.4). The second highest number of stems per hill (5.93) was produced in T_{12} (medium sized whole tuber), which was statistically similar to T_2 (large half cut distal). The minimum number of stems per hill was in T_{11} (1.6). Area of leaf varied significantly among the treatment combinations ranging from 2215 to 3909 cm^2 (Table 2). The maximum area of leaf was found in T_9 and the minimum was observed in T_{14}. The highest number of tubers/hill was observed in the treatment T_6 (10.23). Half cut distal of large, medium and small size tubers (T_2, T_8 and T_{14}) performed better among the different treatment combinations next to the treatments containing whole tuber.

Table 2. Interaction effects of seed size and cutting methods on plant height, stem per hill and leaf area

Treatment	Plant height (cm)			No. of stem /hill	Area of leaf (cm^2)
	30 DAP	45 DAP	60 DAP		
T_1= S_1C_1	13.50 gh	24.33 bcd	30.77 b-e	3.60 de	3786 ab
T_2= S_1C_2	18.87 bc	29.10 ab	36.13 bcd	5.43 b	3609 abc
T_3= S_1C_3	16.13 def	27.87 bc	32.97 bcd	4.67 c	3729 ab
T_4= S_1C_4	12.87 h	26.53 bcd	32.20 b-e	3.33 e	3526 abc
T_5= S_1C_5	13.53 gh	26.13 bcd	29.37 def	3.33 e	3129 bcd
T_6= S_1C_6	21.77 a	33.30 a	43.40 a	8.40 a	3241 a-d
T_7= S_2C_1	15.63 d-g	26.53 bcd	33.07 bcd	3.00 ef	3259 a-d
T_8= S_2C_2	16.80 cde	27.73 bc	32.70 bcd	4.33 cd	2765 de
T_9= S_2C_3	12.83 h	25.20 bcd	31.17 b-e	3.13 ef	3909 a
T_{10}=S_2C_4	10.37 i	21.43 de	26.93 efg	2.13 gh	2923 cde
T_{11}=S_2C_5	9.70 i	14.37 f	22.87 g	1.60 h	2760 de
T_{12}=S_2C_6	20.50 ab	29.43 ab	36.20 b	5.93 b	2684 de
T_{13}=S_3C_1	14.23 fgh	25.10 bcd	30.17 cde	3.00 ef	2328 e
T_{14}=S_3C_2	15.40 efg	27.00 bcd	35.17 bc	3.40 e	2215 e
T_{15}=S_3C_3	12.67 h	23.30 cde	32.00 b-e	2.53 fg	3526 abc
T_{16}=S_3C_4	10.07 i	16.20 f	24.57 fg	1.80 gh	2558 de
T_{17}=S_3C_5	10.20 i	18.33 ef	28.67 def	1.67 h	2309 e
T_{18}=S_3C_6	18.03 cd	26.03 bcd	33.97 bcd	4.27 cd	3125 bcd
CV%	9.30	11.71	9.12	11.63	12.16
Level of significance	*	*	*	*	*

*, Significant at 5 % level of probability. Means in a column followed by the same letters do not differ significantly at 5 % level of significance. 'S' and 'C' indicate seed size (large-S_1, medium-S_2, and small-S_3) and cutting methods (half longitudinal-C_1, half distal-C_2, half proximal-C_3, $1/4^{th}$ crosswise-C_4, $1/4^{th}$ longitudinal-C_5, whole tuber-C_6), respectively

The maximum weight of tubers/hill was found in T_6 (0.40 Kg). The yield of tubers/hill was minimum (0.19 kg) in T_{16}. The highest yield of tubers (25.10 t ha^{-1}) was produced in T_6 (large whole tuber) closely followed by T_{12} (medium size-whole tuber=23.01 t), T_2 (large size-half distal=22.13 t), T_{18} (small size-whole tuber=20.93 t) (Table 3). The results indicated that half distal cut of large sized tubers are comparable to small and medium sized whole tuber, which might be due to more or less equal number of eyes in both cut piece of large sized tubers and whole tuber of small and medium sized. The maximum percentage of tubers of <20mm, 20-28mm, 28-40mm, 40-55mm and >55mm grades were 9.11, 22.43, 48.36, 47.58 and 8.18 in T_5, T_{12}, T_2, T_{11} and $T_{15,}$ respectively. It was found that T_2 produced the maximum percentage (48.36%) of 28-40 mm size tubers.

Table 3. Effects of seed size and cutting methods on number and weight of tubers per hill and yield of tubers / hectare

Treatment	No. of tubers/hill	Wt.of tuber/hill(kg)	Yield (t/ha)
T_1= S_1C_1	5.77 d-g	0.32 cde	17.74 c
T_2= S_1C_2	8.07 b	0.39 ab	22.13 b
T_3= S_1C_3	6.37 cde	0.34 a-d	15.60 cd
T_4= S_1C_4	6.30 c-f	0.38 abc	16.71 c
T_5= S_1C_5	5.80 d-g	0.34 a-d	16.71 c
T_6= S_1C_6	10.23 a	0.40 a	25.10 a
T_7= S_2C_1	5.60 d-g	0.36 abc	15.69 cd
T_8= S_2C_2	6.93 c	0.34 a-d	17.60 cd
T_9= S_2C_3	6.57 cde	0.35 abc	16.21 cd
T_{10}= S_2C_4	5.70 d-g	0.32 cde	9.96 f
T_{11}= S_2C_5	4.03 hi	0.20 gh	7.60 g
T_{12}= S_2C_6	8.10 b	0.39 ab	23.01ab
T_{13}= S_3C_1	5.23 fg	0.27 ef	14.13 de
T_{14}= S_3C_2	6.97 c	0.38 abc	16.01 c
T_{15}= S_3C_3	5.57 efg	0.29 def	12.96 e
T_{16}= S_3C_4	3.80 i	0.19 h	6.15 g
T_{17}= S_3C_5	4.93 gh	0.25 fg	6.53 g
T_{18}= S_3C_6	6.70 cd	0.35 abc	20.93 b
Level of significance	*	*	*
CV%	9.29	11.66	8.38

* Significant at 5 % level of probability. Means in a column followed by the same letter do not differ significantly at 5 % level of probability. 'S' and 'C' indicate seed size (large-S_1, medium-S_2, and small-S_3) and cutting methods (half longitudinal-C_1, half distal-C_2, half proximal-C_3, $1/4^{th}$ crosswise-C_4, $1/4^{th}$ longitudinal-C_5, whole tuber-C_6), respectively

Table 4. Effects of seed size and cutting methods on tuber grade by weight (%)

Treatment	Tuber grade by weight (%)				
	<20mm	20-28mm	28-40mm	40-55mm	>55mm
T_1= S_1C_1	5.40 gh	15.09 g	39.91de	31.80 b	7.77 a
T_2= S_1C_2	8.14 a-d	21.82 ab	48.36 a	19.91g	3.39 l
T_3= S_1C_3	7.20 cde	15.80 fg	42.14 a-d	31.08 bc	5.35 fgh
T_4= S_1C_4	4.09 I	14.85 g	42.25 a-d	30.84 bc	6.43 efg
T_5= S_1C_5	9.11 a	12.48 h	41.97 a-e	31.13 bc	6.81cde
T_6= S_1C_6	7.42 b-e	17.53 def	46.18 a-d	22.72 efg	6.15 cd
T_7= S_2C_1	4.87 hi	17.52 def	43.41 a-d	31.63 b	4.35 ijk
T_8= S_2C_2	8.98 a	21.57 ab	46.56 abc	20.95 g	3.74 kl
T_9= S_2C_3	5.72 fgh	16.34 efg	47.47 ab	25.69 def	6.27c-f
T_{10}= S_2C_4	7.05 de	18.26 def	40.29 cde	28.61 bcd	6.95 bc
T_{11}= S_2C_5	5.40 gh	9.44 i	36.10 e	47.58 a	4.96 hij
T_{12}= S_2C_6	8.06 a-d	22.43 a	48.24 a	19.76 g	3.24 jkl
T_{13}= S_3C_1	5.88 fgh	17.66 def	40.40 cde	26.59 cde	6.25 def
T_{14}= S_3C_2	6.63 ef	18.53 cde	47.07 ab	23.08 efg	6.2 c-f
T_{15}= S_3C_3	6.48 efg	15.96 fg	42.85 a-d	29.27 bcd	8.18 a
T_{16}= S_3C_4	8.57 ab	19.50 bcd	41.25 b-e	27.22 b-e	6.83 ab
T_{17}= S_3C_5	9.10 a	22.40 a	42.30a-d	21.44 fg	4.76 ghi
T_{18}= S_3C_6	8.33 abc	20.85 abc	45.45 a-d	21.63 fg	4.93 fgh
CV%	4.81	4.10	4.53	5.02	7.00
Level of significance	**	*	**	*	*

* & ** indicate significance at 5% & 1% level of probability. Data were analyzed by transforming it in arcsine. "S" and "C" indicate seed size (large-S_1, medium-S_2, and small-S_3) and cutting methods (half longitudinal-C_1, half distal-C_2, half proximal-C_3, $1/4^{th}$ crosswise-C_4, $1/4^{th}$ longitudinal-C_5, whole tuber-C_6), respectively

Small sized tubers (<20 mm grade) are less desired because of the low market price, while medium sized tubers (28-40 mm) are the most desired ones for its seed value and higher market price. Large sized tubers (>40 mm) have low consumer demand, but desired for industrial use and export. Therefore, the results indicate that distal half cut piece of large and medium size tuber are comparable to whole tuber of large size for obtaining high market value. Sultana and Siddique (1991) reported that the cut seed piece had significant influence on the number of main stems, yield of tubers per hill and yield of tubers per hectare. The highest yield of tubers (30.4 t/ha) was obtained from the largest seed piece (35gm) planted at 50cm x 22.5cm spacing. Singh (1993) reported that potato tuber weighing 50gm were cut longitudinally into two pieces of approximately 25gm so that each had at least two prominent eyes and used as seed in different cut-seed treatments. The inter-row spacing was kept constant at 60cm but intra-row spacing for whole seed tubers was kept as per treatments of seed rate of 2, 3 or 4 t/ha. And for cut tubers the intra-row spacing was reduced to half as compared to whole tubers. Average total yield was higher from whole tubers (14.3t/ha) than cut tubers (11.2t/ha) and it increased with planting rate. Net income was highest when whole seed tubers were planted at 4t/ha; this treatment also gave the highest yield of tubers suitable for seed (25-75gm). Hoque (2001) reported that cut tubers having single eye and cut tubers having at least two eyes planted six different spacing, to find the effect of different size of cut tubers on yield and to determine the optimum spacing for cut tubers and profitability of potato. Seed tubers having at least two eyes produces more yield than single eye. Maximum economic return may also be obtained from seed tubers having at least two eye pieces with a spacing of 40 cm x 15 cm (Benefit-Cost ratio = 3.15).

Table 5. Partial budget analysis of potato for different cutting methods and seed size with same spacing.

Treatment	Labour hour/ha				Men Days	Total labour Cost (Tk.)	Seed Cost (Tk.)	Total Variable Cost (Tk.)	Gross Return (Tk./ha)	Net Benefit (Tk./ha)	Benefit Cost Ratio
	Seed cutting	Fertilizer application/ Spraying	Harvesting	Total							
T_1= S_1C_1	300	90	430	820	102	10,200	51,200	61,400	2,70,116	20,87,16	3.39
T_2= S_1C_2	310	90	430	830	104	10,400	65,600	76,000	3,34,286	2,58,286	3.39
T_3= S_1C_3	310	90	430	830	104	10,400	60,000	70,400	2,39,265	1,68,865	2.99
T_4= S_1C_4	250	89	425	764	96	9,600	33,400	43,000	2,52,843	2,09,843	4.83
T_5= S_1C_5	260	89	425	774	97	9,700	32,200	41,900	2,55,197	2,13,297	5.09
T_6= S_1C_6	-	92	427	519	65	6,500	1,15,600	1,22,100	3,76,555	2,54,455	2.08
T_7= S_2C_1	290	89	428	807	101	10,100	46,000	56,100	2,43,761	1,87,661	3.34
T_8= S_2C_2	290	89	428	807	101	10,000	43,470	53,470	2,64,789	2,11,319	3.95
T_9= S_2C_3	260	89	428	777	97	9,700	43,470	53,170	2,50,956	1,97,786	3.71
T_{10}=S_2C_4	270	87	420	777	97	9,700	23,000	32,700	1,50,910	1,18,210	3.61
T_{11}=S_2C_5	290	87	420	798	100	10,000	20,470	30,470	1,21,616	91,146	2.99
T_{12}=S_2C_6	-	90	425	515	64	6,400	69,000	75,400	3,47,586	2,72,186	3.60
T_{13}=S_3C_1	290	87	420	798	100	10,000	16,750	26,750	2,06,143	1,79,393	6.70
T_{14}= $_3C_2$	305	87	420	812	101	10,100	16,750	26,850	2,45,126	2,18,276	8.13
T_{15}=S_3C_3	305	87	420	812	101	10,100	25,000	35,100	2,01,685	1,66,585	4.74
T_{16}=S_3C_4	265	85	415	765	96	9,600	8,250	17,850	94,273	76,423	4.28
T_{17}=S_3C_5	275	85	415	775	97	9,700	11,000	20,700	98,914	78,214	3.78
T_{18}=S_3C_6	-	89	420	509	63	6,300	47,250	53,550	3,14,173	2,60,623	4.86

Labour cost=Tk. 100. 1 man day= 8 hour. Seed price= 25/-per kg (small size), 23/-per kg (medium size),. 20/-per kg (large size). S_1, S_2, S_3 indicates large, medium and small size tubers. "S" and "C" indicate seed size (large-S_1, medium-S_2, and small-S_3) and cutting methods (half longitudinal-C_1, half distal-C_2, half proximal-C_3, $1/4^{th}$ crosswise-C_4, $1/4^{th}$ longitudinal-C_5, whole tuber-C_6), respectively

3.2. Economic analysis

In respect of cutting methods higher labour cost was involved compared to whole tuber. The highest cost of production was Tk.1, 22,100/ha. and gross return was Tk. 3, 76,555/ha in T_6 followed by T_2 where the cost of production was Tk. 76,000 and gross return was Tk. 3,34,286/ha (Table 5). Despite the highest gross return (Tk. 3, 76, 555/ha.), high variable cost (Tk. 1, 22,100) reduced net benefit (Tk. 2, 54,455) and BCR (2.08) in case of large whole tubers (T_6). The highest net benefit (Tk. 2, 72,186) was calculated from T_{12} due to higher gross return (Tk. 3, 47,586) and lower variable cost (Tk. 75,400). Different cutting methods influenced the BCR of potato. It was evident that the highest net return (Tk. 2, 72,186) was found from T_{12} followed by T_{18} (Tk. 2, 60,623), T_2 (Tk. 2, 58,286/ha), T_6 (Tk. 2, 54,455/ha) and the highest BCR was found from T_{14} (8.13).

4. Conclusions

In consideration of producing higher plant height, foliage coverage, no. of stems/hill, no. of tubers/hill, per hectare yield, the large seed size tubers were better than those of smaller ones. Whole tubers performed better in relation to plant height foliage coverage, no. of stems per hill, no. of tubers per hill, per hectare yield than cut tubers, while the half cut distal (C_2) showed better performance than proximal end. Half cut distal parts found the best for producing the marketable tubers. Large whole tubers proved to be the best for maximum vegetative growth, tuber yield/plant and per hectare yield, while large half cut distal parts was the next. Medium whole tubers (T_{12}) proved to be the best in case of net returns /hectare followed by small whole tubers (T_{18}) and large half cut longitudinal (T_2). Small half cut distal (T_{14}) was found to be the best regarding benefit cost ratio (8.13) followed by the small half longitudinal (6.7), large half cut longitudinal (5.09) and small whole tubers (4.86). Considering all the aspects, it was concluded that T_5 from large sized tuber, T_8 from medium sized and T_{14} (½ cut distal) from small sized tuber could be the optimum for planting cut tubers.

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