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Cost and return analysis of phalsa (*Grewia asiatica*L.) propagation by semi-hard wood cuttings

Jyoti Devi[1], Parshant Bakshi[1], V. K. Wali[1], Anil Bhat[2]✉ and Deep Ji Bhat[1]

[1]Division of Fruit Science, SKUAST-Jammu, India.
[2]Division of Agricultural Economics and Statistics, SKUAST-Jammu, India.

✉Corresponding author: anilxxb@rediffmail.com

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ABSTRACT

Phalsa (Grewia asiatica L.) belongs to family Tiliaceae and is native to the Indian sub-continent and South-East Asia. But there is hardly any work which has analysed its costs and returns.In order to evaluate the most profitable treatment, economic analysis of treatments was worked out in terms of net returns and benefit cost (B:C) ratio. The cost and analysis structure of production of 1000 plants through rooting of cuttings was worked out for 15th July, 30th July, 15th August and 30th August planting in combination with IBA (150 ppm, 300 ppm and 450 ppm), NAA (150 ppm, 300 ppm and 450 ppm) and untreated cuttings planted i.e., treatment seven on different dates of planting. The cost incurred on preparation of land (₹500.00), labour charges (₹515.00), Farm yard manure (₹180.00), planting material (₹ 1500.00), irrigation (₹560.00) and depreciation on assets (₹ 79.80) was found to be same in all the treatments. The cost incurred on the preparation of different solutions of IBA in various treatments was found to be ₹403.20 for 450 ppm IBA followed by ₹269.00 for 300 ppm IBA and ₹134.40 for 150 ppm IBA and in case of preparation of NAA it was found to be ₹378.00, ₹252.00 and ₹126.00, respectively. It was found that 30th July was best date of planting of phalsa cuttings and IBA treatment was best among growth regulators treatment. Also phalsa cuttings treated with IBA 300 ppm and planted on 30th July showed highest survival percentage (71%) and net returns (₹ 3496.20) Thus, planting of phalsa cuttings on 30th July and treated with IBA 300 ppm was found to be best treatment combination as evidenced by the cost: benefit ratio of 1:1.97.

Keywords: root, analyse, treatment, production.

Phalsa (Grewia asiatica L.) belongs to family Tiliaceae and is native to the Indian sub-continent and South-East Asia. It is indigenous throughout the Himalayan region. The genus 'Grewia' has 140 species, of which only 'Grewia asiatica' is of commercial importance. It is widely cultivated, especially near cities, in tropical and sub-tropical tracts of the country. Phalsa is capable of growing under neglected and drought conditions where a few other fruit crops can survive. Because of its hardy nature and capability to sustain and grow even under prolonged dry spells with little or no care, its cultivation is assuming great importance in semi-arid and arid zone of the country (Kumar and Reddy, 1997). In India, it is commercially cultivated in the state of Punjab, Haryana, Rajasthan, Uttar Pradesh and Madhya Pradesh. Phalsa is commercially propogated by seed. The freshly extracted seeds should be used for raising seedling but these seeds lose their viability in 90 to 100 days under ordinary storage and 175 to 185 days under cold storage (Bose and Mitra, 1985).

The edible part of phalsa fruit varies from 69 to 93%. The fruits are fair source of phosphorous and iron. Fruits contain 50 to 60% juice, 10 to 11% sugar and 2.0 to 2.5% acid. The fruits are excellent for preparing juice and squash. The ripe fruits are used for preparing refreshing drink in summer having cooling effect besides, the fruit has several medicinal properties. Its fruit is astringent and stomachic. Unripe phalsa fruits alleviate inflammation and are

Table 1.Cost and return analysis of phalsa plant produced in different solutions of IBA, NAA and control on 15th and 30th Julyplanting

S. No.	Items of cost (Rs)	T_1D_1	T_2D_1	T_3D_1	T_4D_1	T_5D_1	T_6D_1	T_7D_1	T_1D_2	T_2D_2	T_3D_2	T_4D_2	T_5D_2	T_6D_2	T_7D_2
1	Preparation of land	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0
2	Labour charges	515.0	515.0	515.0	515.0	515.0	515.0	515.0	515.0	515.0	515.0	515.0	515.0	515.0	515.0
3	Cost of FYM	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0
4	Cost of IBA	134.4	269.0	403.2	-	-	-	-	134.4	269.0	403.2	-	-	-	-
5	Cost of NAA	-	-	-	126.0	252.0	378.0	-	-	-	-	126.0	252.0	378.0	-
6	Planting Material	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0
7	Irrigation Charges	560.0	560.0	560.0	560.0	560.0	560.0	560.0	560.0	560.0	560.0	560.0	560.0	560.0	560.0
8	Depreciation on assets	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8
9	Total	3469.2	3603.8	3738	3460.8	3586.8	3712.8	3334.8	3469.2	3603.8	3738	3460.8	3586.8	3712.8	3334.8
	Return Structure														
1	Number of cuttings	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
2	Survival percenage	59.16	66.67	55.42	57.42	62.38	52.64	50.67	68.00	71.00	60.00	66.42	69.23	57.64	53.33
3	Number of plants survived	591.6	666.7	554.2	574.2	623.8	526.4	506.7	680.0	710	600.0	664.2	692.3	576.4	533.3
4	Price per plant (Rs)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
5	Total value of plants (Rs)	5916.0	6667.0	5542.0	5742.0	6238.0	5264.0	5067.0	6800.0	7100.0	6000.0	6642.0	6923.0	5764.0	5333.0
6	Gross Income (Rs)	5916.0	6667.0	5542.0	5742.0	6238.0	5264.0	5067.0	6800.0	7100.0	6000.0	6642.0	6923.0	5764.0	5333.0
7	Total cost of cultivation (Rs)	3469.2	3603.8	3738.0	3460.8	3586.8	3712.8	3334.8	3469.2	3603.8	3738.0	3460.8	3586.8	3712.8	3484.8
8	Net Return (Rs)	2446.8	2937.1	3063.2	2281.2	2651.2	1551.2	1732.2	3330.8	3496.2	2262.0	3181.2	3333.2	2051.2	1848.2
9	B:C ratio	1.70	1.84	1.48	1.65	1.73	1.41	1.51	1.96	1.97	1.60	1.91	1.93	1.55	1.53

Table 2. Cost and return analysis of phalsa plant produced in different solutions of IBA, NAA and control on 15th and 30th August planting

S.No	Items of cost (Rs)	T_1D_3	T_2D_3	T_3D_3	T_4D_3	T_5D_3	T_6D_3	T_7D_3	T_1D_4	T_2D_4	T_3D_4	T_4D_4	T_5D_4	T_6D_4	T_7D_4
1	Preparation of land	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0
2	Labour charges	515.0	515.0	515.0	515.0	515.0	515.0	515.0	515.0	515.0	515.0	515.0	515.0	515.0	515.0
3	Cost of FYM	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0	180.0
4	Cost of IBA	134.4	269.0	403.2	-	-	-	-	134.4	269.0	403.2	-	-	-	-
	Cost of NAA	-	-	-	126.0	252.0	378.0	-	-	-	-	126.0	252.0	378.0	-
5	Planting Material	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0
6	Irrigation Charges	560.0	560.0	560.0	560.0	560.0	560.0	560.0	560.0	560.0	560.0	560.0	560.0	560.0	560.0
7	Depreciation on assets	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8
8	Total	3469.2	3603.8	3738.0	3460.8	3586.8	3712.8	3334.8	3469.2	3603.8	3738.0	3460.8	3586.8	3712.8	3334.8
	Return Structure														
1	Number of cuttings	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
2	Survival%age	45.16	53.33	40.23	42.24	51.42	37.66	36.50	31.66	41.67	26.48	29.42	38.67	24.32	21.67
3	Number of plants survived	451.6	533.3	402.3	422.4	514.2	376.6	365.0	316.6	416.7	264.8	294.2	386.7	243.2	216.7
4	Price per plant (Rs)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
5	Total value of plants (Rs)	4516.0	5333.0	4023.0	4224.0	5142.0	3766.0	3650.0	3166.0	4167.0	2648.0	2942.0	3867.0	2432.0	2167.0
6	Gross Income (Rs)	4516.0	5333.0	4023.0	4224.0	5142.0	3766.0	3650.0	3166.0	4167.0	2648.0	2942.0	3867.0	2432.0	2167.0
7	Total cost of cultivation (Rs)	3469.2	3603.8	3738.0	3460.8	3586.8	3712.8	3334.8	3469.2	3603.8	3738.0	3460.8	3586.8	3712.8	3334.8
8	Net Return (Rs)	1046.8	1729.2	285.0	763.2	1555.2	53.2	315.2	-303.2	563.2	-1090.0	-518.18	280.2	-1280.8	-1167.8
9	B:C ratio	1.30	1.47	1.07	1.22	1.43	1.01	1.09	0.91	1.51	0.70	0.85	1.07	0.65	0.64

administered in respiratory, cardiac and blood disorders as well as in fever reduction. The root bark is employed in treating rheumatism. The leaves applied on skin eruptions are known to have antibiotic action. The bark is used as a soap substitute in Burma. A mucilaginous extract of the bark is useful in clarifying sugar.

The importance and potential of dry land horticulture is being realized in India of late. Phalsa plant is small bushy and hardy in nature and preferred as an ideal crop for growing in hot and arid regions. It is also preferred for dry land horticulture. Despite this significance, the cultivation of phalsa is limited and very little attention has been paid for the research work on various aspects of its cultivation. Majority of work so far reported is from North India and is mostly concentrated around pruning cum fertilizers studies and fruit processing preservation. But there is hardly any work which has analysed its costs and returns. Keeping these points in view, the cost and return analysis was done for the phalsa. In this process the economics was worked out for rooting of cuttings with the use of auxin at appropriate time of application.

Materials and Methods

The present investigation entitled "Cost and Return Analysis of Phalsa (Grewia asiatica L.) propagation by Semi-hard wood cuttings" was carried out at the Research Farm, Division of Fruit Science, FOA Udheywalla, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu during 2013-14. The details about the experimental site, material used and the methodology adopted during the course of investigation are presented under following sub-heads.

Experimental Details

Treatment details

(i) Plant growth regulators (IBA and NAA)

T1: IBA 150 ppm T2: IBA 300 ppm

T3: IBA 450 ppm T4: NAA 150 ppm

T5: NAA 300 ppm T6: NAA 450 ppm
T7: Control

(ii) Date of planting

i. D1: 15th July, 2013
ii. D2: 30th July, 2013
iii D_3: 15th August, 2013
iv. D_4: 30th August, 2013

(iii) Treatment combinations

T1DI T1D2 T1D3 T1D4

T2D1 T2D2 T2D3 T2D4

T3D1 T3D2 T3D3 T3D4

T4D1 T4D2 T4D3 T4D4

T5D1 T5D2 T5D3 T5D4

T6D1 T6D2 T6D3 T6D4

T7D1 T7D2 T7D3 T7D4

Preparation of growth regulator formulations

Stock solutions of 150, 300, and 450 ppm each of IBA and NAA were prepared separately by dissolving 150, 300, and 450 mg of each chemical in 1000 ml water for respective stock solutions.

Observations Recorded

Survival percentage

The survival percentage was calculated by following formula

Survival (%) = Number of Sprouted cuttings × 100

Number of cuttings planted

Economic Analysis

In order to evaluate the most profitable treatment, economic analysis of treatments was worked out in terms of net returns and benefit cost (B:C) ratio. The net returns and B: C ratio was calculated as follows:

Net returns were calculated by deducting the cost of cultivation from the gross income.

$$\text{B:C ratio} = \frac{\text{Gross return}}{\text{Cost of cultivation}} \times 100$$

Statistical Analysis

The experimental results were statistically analysed as per the methods outlined by Panse and Sukhatme (2000) by adopting Fishers analysis of variance

techniques. The data related to survival percentage and rooting percentage were transformed into square root transformation before analysis. This is because the values above 75 to 100 should be subtracted from 100 before transformation is made. If the results are to be compared, the units should be same otherwise it will render the comparison invalid. The transformation is desired so that the data should satisfy the assumption required, before, it is subjected to statistical analysis, (Steel and Torrie, 1984).

Results

The cost and analysis structure of production of 1000 plants through rooting of cuttings was worked out for 15th July, 30th July, 15th August and 30th August planting in combination with IBA (150 ppm, 300 ppm and 450 ppm), NAA (150 ppm, 300 ppm and 450 ppm) and untreated cuttings planted i.e., treatment seven on different dates of planting. The common cost concepts of agricultural economics were used to interpret the results. The actual costs of various inputs used in the propagation of phalsa cuttings were considered. These costs were worked out for all the treatment combinations separately which includes preparation of land, labour charges,costof FYM, IBA, NAA, planting material, irrigation charges and depreciation of assets. Gross returns from propagation of phalsa cuttings in all the treatment combinations were obtained by sale value of phalsa plants.

Cost and return analysis of phalsa plants produced in different treatments of IBA and NAA in 15th July and 30th July planting and untreated cuttings planted on same dates is presented in table 1. The table revealed that the cost incurred on preparation of land (₹500.00), labour charges (₹515.00), Farm yard manure (₹180.00), planting material (₹1500.00), irrigation (₹560.00) and depreciation on assets (₹79.80) was found to be same in all the treatments and it was because of the equal area of land utilized for all the treatments. The cost incurred on the preparation of different solutions of IBA in various treatments was found to be ₹403.20 for 450 ppm IBA followed by ₹269.00 for 300 ppm IBA and ₹134.40 for 150 ppm IBA and in case of preparation of NAA it was found to be ₹378.00, ₹252.00 and ₹126.00, respectively. The table further revealed that the total cost of cultivation in case of 15th July planting as well as in 30th July planting was observed to be highest (₹3738.00) and same for T3D1and T3D2 whereas it was found to be lowest (₹3334.80) and same for T7D1 and T7D2.

The table further revealed that net returns were higher (₹3496.20) in treatment T2D2 i.e., IBA 300 ppm on 30th July planting whereas it was found to be lowest (₹1732.20) in (T7D1) i.e. control treatment on 15th July planting. It is because of survival percentage which was found to be 71% in treatment combination of 300 ppm IBA along with 30th July planting and 50.67% in untreated cuttings planted on 15th July. The benefit cost ratio ranged from 1:1.41 in T6D1 to 1:1.97 in T2D2 thus indicating that cuttings planted on 30th July and treated with 300 ppm IBA returns ₹1.97 for each rupee invested on it. Exogenous application of auxin on cuttings result in increase of endogenous auxin concentration after wounding coinciding with the initiation of the rooting process (Pop et al, 2011).

Cost and return analysis of phalsa plants produced in different treatments of IBA and NAA on 15th August and 30th August planting and untreated cuttings planted on same dates is presented in table 2. The table revealed that the cost incurred on preparation of land, labour charges, Farm yard manure, planting material, irrigation and depreciation on assets preparation of solution of IBA and NAA was found to be same as incurred during 15th and 30th July. The table further explained that the total cost of cultivation in case of 15th August planting as well as in 30th August planting was observed to be highest (₹3738.00) and same for T3D3 and T3D4 whereas it was found to be lowest (₹3334.80) and same for T7D3 and T7D4.

The table further revealed that net returns were higher (₹1729.20) in treatment T2D3i.e., IBA 300 ppm along with 15th August planting whereas it was found to be lowest (₹-1167.80) in (T7D4) i.e. control treatment on 30th August planting. It is because of survival percentage which was found to be 53.33% in treatment combination of 300 ppm IBA along with 15thAugust planting and 21.67% in untreated cuttings planted on 30thAugust. The benefit cost ratio ranged from 1:0.64 in T7D4 to 1:1.47 in T2D4 thus indicating that cuttings planted on 15thAugust and treated with 300 ppm IBA returns ₹1.47 for each rupee invested on it. From the table it is also observed that during 30th August planting dates there is a

decline in survival percentage of the plants and so in gross as well as net returns which in turn shows decline in benefit-cost ratio. In most of the treatments during this period gross return are less than the cost of cultivation and therefore net returns goes negative which clearly indicates that cuttings planted on 30th August returns less than one for each rupee invested.

Conclusion

It can be concluded from the results that 30th July was best date of planting of phalsa cuttings and IBA treatment was best among growth regulators treatment. Also phalsa cuttings treated with IBA 300 ppm and planted on 30th July showed highest survival percentage. When compared the treatment T2D2 with control T7D2 i.e., untreated cuttings planted on 30th July, the total cost of cultivation was found to be highest ₹3603.80 in T2D2 whereas it was ₹3484.80 in treatment T7D2. The net returns were also found to highest ₹3496.20 when phalsa cutting was treated with IBA 300 ppm and planted on 30th July and that was because of survival percentage which was 71%. Thus, planting of phalsa cuttings on 30th July and treated with IBA 300 ppm was found to be best treatment combination as evidenced by the cost: benefit ratio of 1:1.97.

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