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RESEARCH PAPER

Economic Feasibility of Kiwifruit Cultivation in Lower Subansiri District of Arunachal Pradesh

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ABSTRACT

Kiwifruit cultivation is a promising avenue for horticultural development in the mid-hill regions of Arunachal Pradesh. An attempt has been made to study the economic and financial feasibility of Kiwifruit cultivation in Lower Subansiri District of Arunachal Pradesh. This study was conducted in the Lower Subansiri district Employing a comprehensive approach through purposive sampling, a diverse array of 60 respondents, comprising farmers were engaged across selected villages, namely Tajang, Hija, Hong and Hari and two blocks- Ziro I and Hong-Hari within the district. Utilizing established analytical frameworks, including cost concepts and Benefit Cost Ratio (BCR). From the study it was revealed that the total costs for establishing a kiwifruit orchard per hectare are ₹ 2,72,512.77 for small, ₹ 2,82,199.412 for medium, and ₹ 2,89,991.34 for large orchards, with an overall average of ₹ 2,81,567.8421. The total maintenance cost per hectare is ₹ 31,728.69 for small, ₹ 34,009.76 for medium, and ₹ 35,046.64 for large orchards, with an overall average of ₹ 33,595.03. The gross return from Kiwifruit orchard of small, Medium and large was ₹ 506700/ha, ₹ 5,01,750/ha and ₹ 4,93,200/ha respectively. Despite these cost escalations, returns above expenditure remain promising, with a combined benefit-cost ratio of 1.59, demonstrating the economic viability of kiwifruit cultivation, particularly for small-scale farmers. Moreover, the cost of establishing a kiwifruit orchard is high, thus the government may be advised to give direction to the financial institution to offer loans to the cultivators with fair interest rate. Majority of the orchardists do not get the better remuneration due to low prices of produce and price fluctuations as they are selling their produce immediately after harvest. The reasons for distress sale may be lack of cold storage and low shelf life of kiwifruit. Therefore, to tackle the problem cold storages should be established. Efforts are essential to unlocking the full economic potential of kiwifruit cultivation for fostering sustainable agricultural development and livelihood improvement within the hilly regions of Arunachal Pradesh.

HIGHLIGHTS

- Kiwifruit of Arunachal Pradesh has established a commercial identity in both national and local marketplaces.
- The gross return from Kiwifruit orchard of small, Medium and large was ₹ 506700/ha, ₹ 5,01,750/ha and ₹ 4,93,200/ha respectively.
- Single window delivery system should be encouraged in the hilly regions of Arunachal Pradesh.

Keywords: Kiwifruit Cultivation, Cost Concept, BCR, Economic Potential, Arunachal Pradesh

India's economy is built on agriculture, which is the foundation of the nation. One of the most significant aspects of agriculture in recent times has been horticulture. India is the second-largest

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fruit producer in the world after China. It produces a diverse array of crops under a range of agro-ecological conditions. There has been a notable surge in growth recently in other horticultural areas, including plantation crops, floriculture, medicinal and aromatic plants, mushrooms and tuber crops. India's agricultural development has been significantly fueled by the horticulture industry. Among all farming endeavors, this one has grown to be the most lucrative; it not only creates jobs but also contributes to the advancement of women in the field. The Indian government has placed a strong emphasis on utilizing this sector's potential since it recognizes its significance.

Kiwi (*Actinidia deliciosa*) or Chinese gooseberry is a native to Northern China and it was considered to be a wild fruit and it was largely eaten for medicinal purposes. It is mostly eaten as fresh, while some are also processed into juices, purees, candies, fortified drinks, dehydrated, frozen and lyophilized products, leather, spirits, and syrups (Guroo *et al.* 2017). It has been revealed through extensive research studies that it contains ample amount of nutrients that provide health benefits to the one's consuming it by improving the digestive, immune, and metabolic health of an individual (Richardson *et al.* 2018). It is a potent source of vitamins such as vitamins A, B, C, E, and K and notably appreciable levels of dietary fiber, folate, potassium, and other minerals (Richardson *et al.* 2018). It consists of various phytochemicals such as carotenoids, flavonoids, anthocyanins, and lutein. It possesses various pharmacological properties such as anti-cancerous, anti-diabetic, antifertility, hepatoprotective, antiulcer, prevention of cataracts, and macular degeneration (Nishiyama *et al.* 2004). Owing to the several medicinal properties of kiwi fruit, it has become awfully popular during the past two decades (Tyagi *et al.* 2015). In the early 20th century kiwi fruit had spread from China to New Zealand where the fruit got renamed to kiwifruit, after the New Zealand bird and being cultivated there. Italy is considered to be the largest producer of Kiwi in the world followed by New Zealand and Chile (FAOstat.org). In India, it is a relatively new fruit and grown in Himachal Pradesh, Uttar Pradesh, Jammu and Kashmir, Sikkim, Meghalaya, Arunachal Pradesh, Nagaland, Manipur etc. The annual average production of kiwi in India is about 8.5 thousand tonnes from an area of about 4.63 thousand hectares (Anonymous 2018). Arunachal Pradesh is the largest producer of Kiwi in India having 56 percent (4,800 tons) of the total production (Mani *et al.* 2018). Lower Subansiri district is the highest producer of kiwi from Arunachal Pradesh. Kiwifruit has a bright prospect in Arunachal Pradesh. It provides high return per unit area and the farmers can earn about Rs. 4 to 5 lakhs per hectare annually. Kiwifruit bears heavily every year with no crop failure (Anjalee *et al.* 2020).

Kiwifruit was initially introduced in the Lal Bagh garden, Bangalore, in the 1960s for both ornamental and fruit purposes. However, due to insufficient chilling hours, the plants couldn't bear fruit there. In 1963, it was successfully grown at the Division of Indian Agricultural Research Institute (IARI) in Phagli, Shimla, Himachal Pradesh, under Harbhajan Singh leadership. This led to successful Kiwifruit cultivation in India, with the first commercial orchard established in 1985 at Dr Yashwant Singh Parmar University of Horticulture and Forestry in Solan, Himachal Pradesh. Today, Kiwifruit is grown in various parts of the country, including Himachal Pradesh, Uttarakhand, Jammu and Kashmir, Sikkim, Meghalaya, and Nilgiri hills (Dhiman *et al.* 2023).

Arunachal Pradesh has emerged as one of the largest producers of kiwi fruits (Lepcha, 2020) which is cultivated abundantly in the Ziro Valley. Every year India imports 60,000 tonnes of kiwi from New Zealand, Italy, Greece, and Chile (Patel, 2018). The kiwifruit *Actinidia deliciosa* is referred to as "China's miracle fruit" and "New Zealand's horticultural wonder." The kiwi, also known as "anteri" in the local dialect, is becoming more and more well-liked in the mid-hill regions of Arunachal Pradesh despite only being introduced in 2000. In addition to its great nutritional and therapeutic advantages, kiwifruit has showed tremendous potential in Arunachal Pradesh in recent years. Growers and customers alike have come to love this fruit for its easy maintenance qualities. It has established a commercial identity in both national and local marketplaces. Since there is essentially no other fresh fruit available to compete with kiwifruit from October to December, kiwifruit farming has a huge advantage over other fruit cultivation. Arunachal Pradesh's high altitude roughly 1500–2000 meters in certain areas, including the Ziro Valley combined

with the state's chilling temperature, which sees winters for more than eight or nine months of the year, make the region perfect for the production of kiwifruits. As part of the Mission Organic Value Chain Development Programme for North East Region (MOVCD-NER), the Lower Subansiri district of Arunachal Pradesh became the first in the nation to receive an Organic Certification for Kiwi. The horticultural sector in the state has enormous potential for growth (Raja *et al.* 2021). The present investigation has been undertaken with the objectives to study the economic and financial feasibility of Kiwifruit cultivation in Lower Subansiri District of Arunachal Pradesh.

RESEARCH METHODOLOGY

The technique for the selection followed was purposive sampling technique. Lower Subansiri district was selected out of twenty-six districts based on the high potential of value addition in Kiwifruit. From the selected district, two blocks were selected based on the highest area, production and value addition. Further in each block, two village were selected based on highest area, production and value addition. A total sample of 60 kiwifruit grower respondents were drawn from the selected district, which was 30 small, 20 medium and 10 large farmers of their total agricultural holdings. To meet the objectives in the present study, both primary and secondary data were collected during the agricultural year is 2022-23.

1. A detail sampling plan of Kiwi grower used in the present study is presented below:

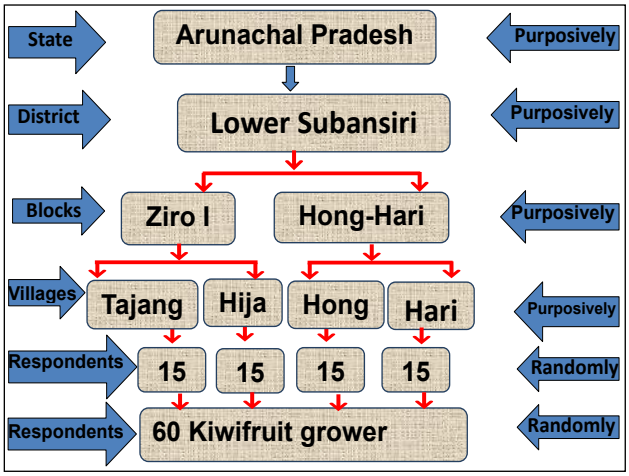

Fig. 1: Schematic representation of sampling plan of Kiwifruit grower

Economics of Kiwifruit production

To analyse the economics of production it is essential to study the cost of production which consists of two parts viz., establishment costs and operational costs. The establishment cost consists of preparation of land and layout, digging and filling of pits, planting materials, planting cost, etc. Operational cost includes the expenditure incurred before fruit bearing and after fruit bearing such as weeding, earthing up, pruning, harvesting, etc.

Cost and return in Kiwifruit cultivation

To study the costs and returns from selected kiwifruit growers, budgeting techniques and various cost concepts were used.

Establishment cost

Construction of plan in any business activity entails some initial cost. Such initial costs are called establishment cost in the business analysis. The establishment cost per hectare of kiwifruit cultivation has been estimated considering the labour used and their respective market price and wages prevailed in the study area. It includes the cost includes the investment for land preparation, digging and filling of pits, material cost *etc.*, were considered during the period of study.

Cost and Return

Cost Concept

Cost concept proposed by Special Expert Committee on 1979, 30th January (Sen and Bhatiya, 2004) will be used to summarize Cost A1, Cost A2, Cost B1, Cost B2, Cost C1 and Cost C2.

Cost A1: consist of following 16 items of costs:

1. Value of hired human labour (Permanent & Casual)
2. Value of owned bullock labour
3. Value of hired bullock labour
4. Value of owned machinery
5. Hired machinery charges
6. Value of fertilizers
7. Value of manure (Produced on farm and purchase)

8. Value of propagating materials (both farm-produced & purchased)
9. Value of insecticides & fungicides
10. Irrigation charges (both of the owned & hired tubewells, pumping set etc.)
11. Canal-water charges
12. Land revenue, cesses and other taxes
13. Depreciation on farm implements (both bullocks drawn & worked with human labour)
14. Depreciation on farm buildings, farm machinery and irrigation structures
15. Interest on the working capital
16. Miscellaneous expenses (wages of artisans, cost of ropes & repairs to small farm implements)

    Cost A2 = Cost A1 + Rent paid for Leased Land

    Cost B1 = Cost A2 + Interest on the fixed capital excluding land

    Cost B2 = Cost B_1 + Rental value of owned land+ rent for leased in land

    Cost C1 = Cost B1 + Imputed Value of Family labour

    Cost C2 = Cost B2 + Imputed Value of Family labour
17. Rent Paid for Leased land +
18. Imputed value of owned land (less land revenue paid there upon) +
19. Imputed interest on owned fixed capital (excluding land)+
20. Imputed value of family labour

Income Measures

1. Farm Business Income = Gross Return - Cost A1.
2. Owned Farm Business Income = Gross Return - Cost A2.
3. Family Labour Income = Gross Return - Cost B2.
4. Net Income = Gross Return - Cost C2
5. Farm Investment Income = Net Income + Imputed rental value of owned land + Interest on fixed capital.

Or, Farm Business Income-Imputed value of Family Labour

Benefit Cost Ratio (BCR)

It is one of the discounted measures that are used to assess the credit-worthiness of the project. Here we compare the present worth of cost with present worth of cost with present worth of benefits. This ratio is obtained by dividing the sum of the present worth of benefit stream of the project with sum of the present worth of cost stream. Therefore, when the B-C ratio is higher than 1, some kind of magnified income will be attained. The mathematical formula for working out this ratio is given as:

$$\text{B-C Ratio} = \sum_{t=1}^{n} \left\{ \frac{Bt}{(1+i)^t} \div \frac{Ct}{(1+i)^t} \right\}$$

Where,

Bt = the benefit stream i.e. benefits of the farm question in t^{th} year

Ct = the cost stream i.e. cost of the farm in question in t^{th} year

t = 1 to t years i.e. life span of the project

i = the interest rate or discount rate at which funds are borrowed

RESULTS AND DISCUSSION

The Lower Subansiri district of Arunachal Pradesh hosted the study because kiwifruit have a high potential for value addition. The main product grown on plantations is kiwifruit, and starting an orchard requires a large initial investment. Kiwifruits grow for a very long time. It can regularly generate output crops for up to 30 years if management practices are excellent. The initial investment and ongoing costs associated with caring for the plants throughout their dormant state are included in the cost of starting a kiwifruit plantation. Before the plant produces fruit, it may take up to four years for it to gestate. Consequently, the costs associated with starting a kiwifruit orchard take four years.

It was observed that the total number of man-days, machine-hours, hired labour, family labour, seedlings, FYM, T-bar, iron wire, and fencing needed to establish a kiwifruit orchard was estimated at 41.64/ha, 36.13/ha, and 41.56/ha. Additionally, there were 235 seedlings/ha, 227.23 quintals/ha, 276.34 kg/

ha, 1696.81 kg/ha, and 2319 kg/ha. The establishment of a kiwifruit orchard required a significant amount of hired labour from large farmers (47.2 man days), with medium and small farmers following closely behind (40.75 and 36.97 man days, respectively). Regarding family labour, the pattern was similar: large farmers utilized family labor the most (33.2 man days), followed by medium farmers (36.65) and small farmers (38.54 man days). Medium farmers and small farmers had the lowest desire for machine labour, while large farmers had the highest demand. Likewise, it was found that medium farmers had the most demand for seedlings, with small and medium farmers following. Large farmers had the highest demand for FYM, T-bar, iron wire, and fencing, with medium and small farmers following suit. It is clear that when farmers grew in size, so did the need for hired labour, even in the case of family labor (Table 1).

Establishment cost of kiwifruit orchard during pre-bearing period

The establishment cost includes the following items: T-bar, iron wire, iron ploughs, baskets, sickles, spades, fencing, manures, planting and seedlings, hired labour, family labour, machine labour, interest on working and fixed capital, land revenue, land rental value, and depreciation. These establishment expenditures were incurred from the first to the fourth year of a four-year pre-bearing period (Table 2).

It was observed that the economic analysis of kiwifruit orchard establishment costs during the pre-bearing period provides a detailed breakdown of expenses incurred per hectare. The variable costs encompass hired labour (₹ 22,180.2/ha - ₹ 28,320/ha; 8.14% - 9.76%), family labour (₹ 23,120.4/ha - ₹ 19,920/ha; 8.48% - 6.86%), machine labour (Tillage, Labeler, opening pit etc.) (₹ 33,013.33/ha - ₹ 33,440/ha; 12.11% - 11.53%), seedlings (₹ 23,600/ha - ₹ 22,850/ha; 8.66% - 7.78%), manure (₹ 38,010.00/ha - ₹ 43020/ha; 13.95% - 14.84%), and miscellaneous expenses (₹ 2280/ha - ₹ 3390/ha; 0.84% - 1.16%). These variable costs contribute to a total working capital ranging from ₹ 1,42,203.006/ha to ₹ 1,50,940/ha, accounting for 52.18% - 52.05% of the total costs. The interest on working capital is calculated at 7%, adding an additional 3.65% to the costs (Table 2).

The fixed capital expenses include T bar (₹ 39,150/ha - ₹ 44,100/ha; 14.36% - 15.20%), fencing (₹ 45,510/ha - ₹ 47,300/ha; 16.7% - 16.31%), iron wire (₹ 16,716.67/ha - ₹ 17,175/ha; 6.14% - 5.92%), with depreciation at 3% and rental value of own land both contributing less than 2% each. The total fixed capital ranges from ₹ 1,09,876.78/ha to ₹ 1,17,259.58/ha, making up 40.32% - 40.44% of the total costs. Interest on fixed capital excluding land is set at 10%, adding another 3.85% to the overall financial requirement. The total costs for establishing a kiwifruit orchard per hectare are ₹ 2,72,512.77/ha for small, ₹ 2,82,199.41/ha for medium, and ₹ 2,89,991.34/ha for large orchards, with an overall average of ₹ 2,81,567.84/ha. The cost categories A1, A2, B1, B2, C1, and C2 reflect varying levels of cost inclusion, with percentages ranging from 85.83% to 100% respectively (Table 2).

Requirement of inputs during bearing period of kiwifruit orchard

It was observed that the total estimated input requirements for maintaining kiwifruit orchards, including hired labour, family labour, and manure, were 9.38 man days, 8.05 man days, and 48.68 quintals, respectively. Large and small farmers

Table 1: Inputs used during pre-bearing period of kiwifruit orchard (Per Hectare)

Sl. No.	Particulars	Unit	Small (n=30)	Medium (n=20)	Large (n=10)	Overall (n=60)
1	Hired labour	Man days	36.97	40.75	47.2	41.64
2	Family labour	Man days	38.54	36.65	33.2	36.13
3	Machine labour	Machine hours	41.27	41.6	41.8	41.56
4	Seedlings	Number	236	240.5	228.5	235
5	FYM	Quintals	211.17	231.5	239	227.23
6	T-bar	Kg	261	274	294	276.34
7	Iron wire	Kg	1671.67	1701.25	1717.5	1696.81
8	Fencing	Kg	2272.5	2320	2365	2319.17

Table 2: Cost of establishment of kiwifruit orchard during pre-bearing period (₹/ha)

Sl. No.	Particulars	Small (n=30)	Medium (n=20)	Large (n=10)	Overall (n=60)
	Variable cost				
1	Hired labour	22180.2 (8.14)	24450 (8.66)	28320 (9.76)	24983.4 (8.87)
2	Family labour	23120.4 (8.48)	21990 (7.79)	19920 (6.86)	21676.8 (76.98)
3	Machine labour	33013.33 (12.11)	33280 (11.79)	33440 (11.53)	33244.45 (11.81)
4	Seedlings	23600 (8.66)	24050 (8.52)	22850 (7.78)	23500 (8.35)
5	Manure	38010 (13.95)	41670 (14.76)	43020 (14.84)	40900 (14.53)
6	Miscellaneous	2280 (0.84)	2510 (0.89)	3390 (1.16)	2726.66 (0.97)
7	Total Working Capital	142203 (52.18)	147950 (52.43)	150940 (52.05)	147031.3 (52.22)
8	Interest on Working capital @ 7%	9954.27 (3.65)	10356.5 (3.67)	10565.8 (3.64)	10292.19 (3.65)
	Fixed Capital or Expenses				
9	T bar	39150 (14.36)	41100 (14.56)	44100 (15.20)	41450 (14.72)
10	Fencing	45510 (16.7)	46400 (16.44)	47300 (16.31)	46403.33 (16.48)
11	Iron wire	16716.67 (6.14)	17012.5 (6.03)	17175 (5.92)	16968.06 (6.1)
12	Depreciation @ 3%	3041.3 (1.12)	3135.37 (1.11)	3257.25 (1.12)	3144.64 (1.12)
13	Rental value of own land	5000 (1.83)	5000 (1.77)	5000 (1.72)	5000 (1.77)
14	Land Revenue	449.816 (0.16)	436.59 (0.15)	427.33 (0.15)	437.91 (0.15)
15	Total Fixed capital	109876.78 (40.32)	113084.46 (40.07)	117259.58 (4044)	113403.94 (40.27)
16	Interest on fixed capital excluding land @ 10%	10486.77 (3.85)	10808.44 (3.83)	11225.96 (3.87)	10840.39 (3.85)
	Total Cost	272512.77 (100)	282199.41 (100)	289991.34 **(100)**	**281567.84 (100**)
17	Cost-A1	233905.59 (85.83)	244400.96 (86.61)	253845.38 (87.54)	244050.6 (86.67)
18	Cost-A2	233905.59 (85.83)	244400.96 (86.61)	253845.38 (87.54)	244050.6 (86.67)
19	Cost-B1	244392.37 (89.68)	255209.4 (90.44)	265071.34 (91.41)	254891.04 (90.53)
20	Cost-B2	249392.37 (85.83)	260209.4 (92.21)	270071.34 (93.13)	259891.04 (92.31)
21	Cost-C1	267512.77 (98.16)	277199.4 (98.23)	284991.34 (98.27)	276567.84 (98.23)
22	Cost-C2	272512.77 (100)	282199.4 (100)	289991.34 (100)	281567.84 (100)

Figures in parenthesis are in percentage.

Table 3: Inputs used during bearing period for maintenance of kiwifruit orchards (Per hectare)

Sl. No.	Particulars	Unit	Small (n=30)	Medium (n=20)	Large (n=10)	Overall (n=60)
1	Hired labour	Man days	8.6	10.4	9.7	9.57
2	Family labour	Man days	9.7	9.25	9.2	9.38
3	Manure	Quintals	44.2	49.85	52	48.68

needed 9.7 and 8.6 man days of hired labor, respectively, while medium farmers needed 10.4 man days for orchard maintenance. The pattern for family labour was 9.7 man days for small farmers, 9.25 man days for medium farmers, and 9.2 man days for large farmers. The requirements of large farmers were assessed to be the highest at 52 quintals, followed by those of medium and small farmers at 49.85 and 44.2 quintals, respectively. The table suggests that as we move from large to medium kiwifruit orchardists, the amount of input needed for establishment increases (Table 3).

Maintenance cost of kiwifruit during bearing period

The cost of maintenance includes labour that is hired or performed by family members, manures, fertilizers, interest on working and fixed capital, land revenue, and depreciation. The maintenance costs that were incurred annually during the kiwifruit bearing season (Table 4).

The maintenance costs of kiwifruit orchards during the bearing period, as outlined are critical for understanding the ongoing financial commitments required for sustainable production. The total

maintenance cost is ₹ 31,728.69/ha for small, ₹ 34,009.76/ha for medium, and ₹ 35,046.64/ha for large orchards, with an overall average of ₹ 33,595.03/ha. The variable costs form the bulk of these expenses, with hired labour (₹ 5,160/ha - ₹ 6,240/ha; 16.26% - 18.34%), family labour (₹ 5,820/ha - ₹ 5,520/ha; 18.34% - 15.75%), manure (₹ 7,956/ha - ₹ 9,360/ha; 25.1% - 26.71%), and miscellaneous costs (₹ 2,280/ha - ₹ 3,390/ha; 7.18% - 9.6%) being the primary components. These variable costs contribute to a total working capital of ₹ 21,216/ha - ₹ 24,090/ha, accounting for 66.86% - 68.74% of the total costs. The interest on working capital at 7% adds an additional 4.68% - 4.81% to the financial outlay (Table 4).

The fixed capital expenses include depreciation at 3% (₹ 3,041.3/ha - ₹ 3,257.25/ha; 9.58% - 9.29%), rental value of own land (₹ 5,000/ha; 15.76% - 14.26%), and land revenue (₹ 165.58 - ₹ 170.33; 0.52% - 0.48%), which together constitute 25.86% - 24.1% of the total costs. The interest on fixed capital at 10% further contributes 2.58% - 2.41%. The cost categories A1, A2, B1, B2, C1, and C2, which include varying degrees of cost considerations, range from 63.31% to 100% of the total costs. Move over, similar studies have been reported by Tassang (2022). This detailed financial breakdown is essential for agricultural economists to assess the economic viability of kiwifruit production, inform pricing strategies, and guide investment decisions in the context of market dynamics and profitability potential (Table 4).

Maintenance cost of kiwifruit orchard during bearing period

Yield and returns

The gross returns at the farm level, which came out to be ₹ 5,00,550 ha. The greatest yield was recorded by small farmers, who produced 2,815 kg/ha. Medium farmers came in second with 2,787.5 kg/ha, and large farmers came in third with 2,740 kg/ha. Additionally, the category of small farmers had the greatest total gross returns, at ₹ 5,06,700/ha, ₹ 5,01,750/ha, and ₹ 4,93,200/ha, respectively, followed by medium and big farmers. The cost per kilogram of kiwifruit was ₹ 180. A declining return trend was noted as a result of low plant population and neglect brought on by holdings fragmentation as farm size rose (Table 5).

Table 4: Maintenance cost of kiwifruit during kiwifruit bearing period **(₹/hectare)**

Sl. No.	Particulars	Small (n=30)	Medium (n=20)	Large (n=10)	Overall (n=60)
	Variable Cost				
1	Hired labour	5160 (16.26)	6240 (18.34)	5820 (16.61)	5740 (17.08)
2	Family labour	5820 (18.34)	5550 (16.32)	5520 (15.75)	5630 (16.76)
3	Manure	7956 (25.1)	8973 (26.38)	9360 (26.71)	8763 (26.1)
4	Miscellaneous	2280 (7.18)	2510 (7.38)	3390 (9.6)	2726.67 (8.12)
5	Total Working Capital	21216 (66.86)	23273 (68.43)	24090 (68.74)	22859.67 (68.1)
6	Interest on working capital @ 7%	1485.12 (4.68)	1629.11 (4.79)	1686.3 (4.81)	1600.17 (4.76)
	Fixed Capital or Expenses				
7	Depreciation @ 3%	3041.3 (9.58)	3135.375 (9.21)	3257.25 (9.29)	3144.64 (9.36)
8	Rental value of own land	5000 (15.76)	5000 (14.71)	5000 (14.26)	5000 (14.88)
9	Land Revenue	165.58 (0.52)	144.31 (0.43)	170.33 (0.48)	160.07 (0.47)
10	Total Fixed capital	8206.88 (25.86)	8279.685 (24.34)	8427.58 (24.1)	8304.7 (24.72)
11	Interest on fixed capital @ 10%	820.688 (2.58)	827.9685 (2.43)	842.758 (2.41)	830.47 (2.47)
	Total Cost	31728.69 (100)	34009.7635 (100)	35046.64 (100)	33595.03 (100)
12	Cost-A1	20088 (63.31)	22631.795 (66.54)	23683.88 (69.63)	22134.56 (65.88)
13	Cost-A2	20088 (63.31)	22631.795 (66.54)	23683.88 (69.63)	22134.56 (65.88)
14	Cost-B1	20908.69 (65.89)	23459.7673 (68.97)	24526.64 (72.12)	22965.03 (68.36)
15	Cost-B2	25908.69 (81.65)	28459.7635 (83.68)	29526.64 (86.81)	27965.03 (83.24)
16	Cost-C1	26728.69 (84.24)	29009.7635 (85.29)	30046.64 (88.35)	28595.03 (85.12)
17	Cost-C2	31728.69 (100)	34009.7635 (100)	35046.64 (100)	33595.03 (100)

Figures in parenthesis are in percentage.

Table 5: Returns from kiwifruit orchard

Sl. No.	Particulars	Small (n=30)	Medium (n=20)	Large (n=10)	Overall (n=60)
1	Yield (kg/ha)	2815	2787.5	2740	2780.83
2	Selling price (₹/kg)	180	180	180	180
3	Gross returns (₹/ha)	506700	501750	493200	500550

Table 6: Returns from kiwifruit orchards over different costs (₹/hectare)

Sl. No.	Particulars	Small (n=30)	Medium (n=20)	Large (n=10)	Overall (n=60)
1	Gross Income	506700	501750	493200	500550
2	Return over Cost-A1	486612	479118.2	469516.12	478415.4
3	Return over Cost-A2	486612	479118.2	469516.12	478415.4
4	Return over Cost-B1	486142.29	478660.35	469020.06	477940.9
5	Return over Cost-B2	485976.71	478516.04	468829.73	477774.2
6	Return over Cost-C1	480156.71	472966.04	463309.73	472144.2
7	Return over Cost-C2	474336.71	467416.04	457789.73	466514.2

Table 5 revels that the kiwifruit yields have been decreasing among small, medium, and large farmers. This trend can be attributed to differential attention given to orchard management. Small-scale farmers, constrained by limited resources, prioritized their orchards more diligently, resulting in better yields. Conversely, larger farmers were facing challenges in maintaining the same level of care and attention because their farm size large.

Returns over different costs from kiwifruit orchards

To assess the profitability of kiwifruit production, the farmers' gross returns were subtracted from cost-A1, cost-A2, cost-B1, cost-B2, cost-C1, and cost-C2. A review of the table revealed that the anticipated gross income of farmers was ₹ 5,00,550/ha altogether. The highest gross income was reported by small farmers, at ₹ 5,06,700/ha, ₹ 5,01,750/ha, and ₹ 4,93,200/ha, respectively, followed by medium and large farmers. After deducting expenses from farmers' gross income, returns above (cost-A1, cost-A2, cost-B1, cost-B2, cost-C1, and cost-C2) were ₹ 4,78,415.4/ha, ₹ 4,78,415.4/ha, ₹ 4,77,940.9/ha, ₹ 4,77,774.2/ha, ₹ 4,72,144.2/ha, and ₹ 4,66,514.2/ha, respectively, at the level of all farms. With a value of ₹ 4,86,612/ha, small farmers had the highest return over cost-A2, followed by medium and large farmers with values of ₹ 4,79,118.20/ha and ₹ 4,69,516.12/ha. Similarly, the returns on cost B2 for small, medium, and large farmers were ₹ 4,85,976.71/ha, ₹ 4,78,516.04/ha, and ₹ 4,68,829.73/ha, in that order. Furthermore, it was found that the return over cost-C2 for small, medium, and large farmers was ₹ 4,74,336.71/ha, ₹ 4,67,416.04/ha, and ₹ 4,57,789.73/ha, respectively. The finding indicated that small orchards yielded a higher return per hectare in comparison to larger orchards. It might also turn out that, in terms of returns, small farmers performed better than medium-sized and large farmers. The profitability of the farm declined as it grew in size because of lower returns (Table 6).

Financial feasibility of kiwifruit orchard

Determining a project's solvency and repayment capacity requires evaluating its financial viability, particularly if an enormous initial investment is involved. In the case of kiwifruit, it is very significant. Therefore, project assessment techniques such the benefit-cost ratio was used to compute cash flow analysis in the case of small, medium, and large farmers.

Benefit Cost Ratio (BCR) of Kiwifruit cultivation

The Benefit Cost (BCR) ratio is a fundamental indicator of profitability, with the data showing a small-scale orchard having a BC ratio of 1.66, a medium-scale at 1.59, and a large-scale at 1.52, with an overall average of 1.59. These findings are in close conformity with Thanwal and Ramchandra (2023). This descending trend suggests that smaller

Table 7: Financial Feasibility of Kiwifruit Orchards

Sl. No.	Particulars	Small (n=30)	Medium (n=20)	Large (n=10)	Overall (n=60)
1	BCR	1.66	1.59	1.52	1.59

orchards are more cost-effective, likely due to lower overheads and more efficient resource utilization. Despite this, all scales maintain a BC ratio above 1, indicating that kiwifruit orcharding is a viable investment regardless of the operation size (Table 7).

CONCLUSION

This study indicates that investment in Kiwifruit orchards is a profitable enterprise for the orchardists of Lower Subansiri District of Arunachal Pradesh. The establishment cost of kiwifruit orchards includes planting material, land preparation, and labor, with total working capital ranging from ₹ 142203.006/ha to ₹ 150940/ha, and total fixed capital from ₹ 109876.786/ha to ₹ 117259.58/ha. The overall cost A1, cost A2, cost B1, cost B2, cost C1, cost C2 are ₹ 244050.6/ha, 244050.6, 254891.04, 259891.04, 276567.84 and ₹ 281567.8421/ha respectively indicating an increase in cultivation costs over the years. Variable costs contribute to 52.18% - 52.05% and fixed costs to 40.32% - 40.44% of total kiwifruit orchard establishment costs, with total costs ranging from ₹ 272,512.777 to ₹ 289,991.34 per hectare. Cost categories A1 to C2, reflecting different cost inclusions, constitute 85.83% to 100% of the total costs. Kiwifruit orchard maintenance costs per hectare range from ₹ 31,728.69 to ₹ 35,046.64, with variable costs (66.86% - 68.74%) primarily comprising labour and manure expenses. Fixed capital expenses (25.86% - 24.1%) include depreciation and land costs, with interest on capital adding an additional 7.26% - 7.22% to the total costs. The profitability of kiwifruit farming, assessed by subtracting costs (A1-C2) from gross returns (₹ 5,00,550), showed returns ranging from ₹ 4,66,514.2 to ₹ 4,78,415.4. Small farmers had higher returns (up to ₹ 4,86,612), indicating better performance and profitability, which decreased with increasing farm size. The combined benefit-cost ratio for all farmers is 1.59, with small farms having the highest ratio of 1.67, followed by medium (1.59) and large farms (1.52).

Moreover, the cost of establishing a kiwifruit orchard is high, thus the government may be advised to give direction to the financial institution to offer loans to the cultivators with fair interest rate. Majority of the orchardists do not get the better remuneration due to low prices of produce and price fluctuations as they are selling their produce immediately after harvest. The reasons for distress sale may be lack of cold storage and low shelf life of kiwifruit. Therefore, to tackle the problem cold storages should be established. Lack of skilled labour was one of the major constraints faced by the farmers. Therefore, the government agencies as well as KVK should come forward for providing skill-oriented training programmes in order to solve the problem of lack of skill labour. Government should ensure the availability of quality healthy seedlings by providing subsidy or loans for establishing seedling nurseries. Incentives in the form of crop insurance availability of improved cultivations and single window delivery system should be encouraged in the hilly regions of Arunachal Pradesh.

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