



An Economic Analysis of Pigeon Pea Production in Maharashtra State, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study is based on "An economic analysis of pigeon pea production in districts of Maharashtra state". The study was conducted in districts were highest area under pigeon pea cultivation in Maharashtra of India. The present study was based on primary data collected from 120 farmers in districts of Maharashtra, during the agricultural year 2021-22. The cost concepts approach to farm costing is widely used in India. To work out the cost of cultivation standard method of cost of cultivation employed by commission on Agricultural Costs and Price (CACP) Ministry of Agriculture (GOI). The directorate of economics and statistics, Government of India estimated different costs as (Cost A1, Cost A2, Cost B1, Cost B2, Cost C1, Cost C2, and Cost C3) The total cost of cultivation of pigeon pea came to ₹. 50548.17 per hectare in which the share of Cost-B2 was Rs.44708.43 (88.45 %) followed by Cost-A2 was ₹. 30053.85 (59.46 %). Per quintal average price of pigeon pea was ₹. 6198.58. Gross returns were ₹. 84345.37 in which main produce was of ₹.79465.90 and by produce ₹. 4919.02. The per hectare net profit from pigeon pea cultivation crop was gained ₹.33797.20. Hence, the cost benefit ratio was highest i.e. 1.67.

Keywords: Cost and returns; profitability of pigeon pea.

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1. INTRODUCTION

"Pulses are known as unique jewels of Indian farming. Pulses continued to be an integral component of sustainable crop-production system, as these crops have ability of biological nitrogen fixation. Pulses play an important role to enhance the fertility of soil in terms of yield of subsequent crop to the tune of about 20-40 per cent has been recorded. Pulses are an important and relatively inexpensive source of protein for human and animal nutrition and commonly called the poor man's meat. Pulses are an integral part of many diets across the globe and they have great potential to improve human health, conserve soil, protect the environment and contribute to global food security, besides serving as an important source of protein for a large portion of the global population" [1-3]. Knowing the values of pulses, United Nations declared 2016 as the "International Year of Pulses". The IYP 2016 aims to heighten public awareness of the nutritional benefits of pulses as part of sustainable food production aimed towards food security and nutrition. Pulses are consumed as Dal, which is a cheap source of plant protein [4,5] These are consumed because of body building properties due to presence of various amino acids. By products of pulses like leaves, pod coats and bran are fed to animals in the form of dry fodder. Some pulse crops like gram, black gram and green gram are fed to animals as green fodder [6-8]. moong plants are also used as green manure which improve soil health and adds nutrient into the soil. Pulses are cultivated in all parts of the world and occupy an important place in human diet. India, Brazil, China, Turkey and Mexico are major pulses producing countries in the world. The pulses are an important source of protein for the poor as well as for the vegetarians. Pulses are a Smart Food as these are critical for food basket (dal-roti, dal-chawal), important source of plant protein and help address obesity, diabetes etc [9,10].

"In the world, pulses are grown by 171 countries. At triennium ending 2022-23, the total area under pulses was 723 MH. This area provided about 644.08 LT of pulses with a productivity of 890 kg / ha. The highest area was contributed by India (32.24 %) followed by Niger (7), Myanmar (5.33), Brazil (5.29) and Nigeria (4.44). Similarly, the contribution to total production by India was 23.46%, Canada 7.93, China 7.09, Myanmar 6.89 and Brazil 5.29. The highest productivity was of France (4219 kg /ha) followed by Canada

(1936), USA (1882), Russian Federation (1643) and China (1596). There was 239 lakh ha area in India (2019-20), which was mainly contributed by Madhya Pradesh, Rajasthan, Maharashtra, Karnataka and Uttar Pradesh. From this area, 158 MH produce of pulse was received. The major contributors of this production were Madhya Pradesh, Maharashtra, Uttar Pradesh, Rajasthan and Andhra Pradesh. During this period, productivity of pulses was recorded 661 kg / ha with highest in Punjab (905 kg/ha), Haryana (891), Bihar (839), Uttar Pradesh (823) and West Bengal (811)". [Govt. of India, Ministry of Agril, Bhopal-2022]. "Madhya Pradesh is the major pulse producing state in the country, both in terms of area (22.81%) and production (31.07%) followed by Rajasthan area (15.33%) and production 11.86%, Maharashtra (area 13.29%) and production 8.56%), Karnataka area (11.01%) and production (8.43%) and Uttar Pradesh (area 7.38% and production 7.40%). Maharashtra ranks third amongst the Indian states in terms of area and production under pulses. The productivity of pulses in the state is very low (420 kg/ha) as compared to the other leading states". (www.Directorate of Economics and Statistics.com)

2. MATERIALS AND METHODS

The Maharashtra state was selected purposively as a study area, because in the state variety of pulses are being cultivated on a large scale and hence Maharashtra is considered as one of the pulse hub of India. Multi stage sampling technique was adapted in the sample selection. At the first stage data regarding area under pigeon pea in the districts of the state was collected and based on the highest area under crop, four district were selected. At the second stage of sampling, from each selected districts one block having highest area under pigeon pea was selected. At the third stage, from each selected block three villages having maximum area under the pigeon pea crop was selected purposively. In the final stage of sampling, from each of the selected villages, a list of pigeon pea growers having highest acreage was obtained from the revenue records maintained at selected villages. The ten farmers from each selected villages for pigeon pea crop was selected separately by simple random sampling technique. Thus, the total sample from twelve villages for pigeon pea crop was 120 respondents.

To work out the cost of cultivation standard method of cost of cultivation employed by

commission on Agricultural Costs and Price (CACP) Ministry of Agriculture (GOI). The directorate of economics and statistics, Government of India estimated different costs as Cost A₁, Cost A₂, Cost B₁, Cost B₂, Cost C₁, Cost C₂, and Cost C₃.

2.1 Cost Concepts

These include cost A₁, A₂, B₁, B₂, C₁ and C₂
Cost A₁ = It include cash and kind expenses actually incurred by cultivators which are as follows :

1. Value of hired human labour.
2. Value of hired machinery.
3. Value of owned machinery.
4. Value of owned/purchased manures.
5. Value of fertilizers.
6. Value of owned/purchased seed.
7. Value of plant protection chemicals.
8. Value of Irrigation charges.
9. Interest on working capital.
10. Depreciation farm machinery, Implement, equipment, farm building etc.
11. Miscellaneous expenses

Cost A₂ : Cost A₁ + Rent paid for leased in land

Cost B₁ : Cost A₂ + Interest on the owned fixed capital assets (excluding land)

Cost B₂ : Cost B₁ + Rental value of owned land (net of land revenue)

Cost C₁ : Cost B₁ + Imputed value of family labour.

Cost C₂ : Cost B₂ + Imputed value of family labour.

Cost C₃ : Cost C₂ + 10 percent of Cost C₂ (Managerial Cost)

Similar study was conducted by Bhagwat et al, [11]. The data on costs and returns was related to the year 2021-22.

3. RESULTS AND DISCUSSION

3.1 Costs, Returns and Profitability of Pigeon Pea Growers

To study the cost, returns and profitability in pigeon pea production the physical inputs required were taken and converted into monetary term to determine the cost of cultivation per hectare. Similarly, main produce and by produce were converted into monetary terms to know the gross returns. Thus, with the help of costs and returns, profitability of pigeon pea production was determined as follows.

3.2 Per Hectare Physical Inputs and Output of Pigeon Pea

The utilization of input pattern indicates the farmer's efficient management of resources, their choice and decision making. As well this, it indicates the level and capacity of the farmer. The farmer had to spend on various inputs like seed, fertilizer, manure, human labour, pest and disease management, bullock labour etc. Therefore, it is necessary to know the exact pattern of input expenditure on various resources on a per hectare basis. All types of inputs are very important in the farming business, for the proper use and distribution leading to the success of farming. Per hectare, input utilization and output from pigeon pea crop for the selected pigeon pea growers are illustrated in Table 1.

Per hectare physical inputs and output of pigeon pea was calculated and presented in Table 1. Results revealed that use of hired human labour and the family human labour was 23.02man days and 21.33 man days respectively. Use of bullock labour was 3.83 pair days while the use of machine labour was 14.75 hours. In case of seeds 3.62 kg /ha used. In case of fertilizers, use of Phosphorus was 57.85 kg followed by 22.63 kg of Nitrogen and potash was used i.e. 21.99 kg/ha , while 1.64 liters of plant protection was used to control pest and diseases on pigeon pea. It was observed from the Table 1. that per hectare main produce of pigeon pea (grain) was 12.82 qtl. and by produce (straw) was 2.05 qtl.

The main produce was achieved by using the proper production technology and efficient utilization of resources. The seed which was used to the optimum level and maintaining the ideal plant population resulted in less pest and disease incidence, indeed minimizing to the less number of insecticide spray ultimately reducing the input cost. Though the sprays were minimum, but were taken at the appropriate time when needed the most specifically at the economic threshold level of pest incidence. Fertilizer use was also planned according to the soil testing reports and used as per its recommendation. Micronutrient was also used to balance the complete nutrient need of the pigeon pea crop, resulted in improving the grain size and test weight of the pigeon pea grains, ultimately resulting in the higher yield of pigeon pea crop (12.82 qtl/ha) The weedicide sprays were scheduled timely and followed by hoeing and manual weeding by female labour along with family female labour. The yield of by produce

Table 1. Per hectare physical inputs and output of pigeon pea cultivation

Sr. no	Particulars	Unit	Quantity
INPUT			
1	Hired human labour		
	Hired male	man days	8.03
	Hired female	man days	14.99
			23.02
2	Family labour		
	Male	man days	10.10
	Female	man days	11.23
			21.33
3	Bullock labour	pair days	3.83
4	Machine labour	hours	14.75
5	Seed	kg	3.62
6	Manures	tons	2.02
7	Fertilizers		
	N	kg	22.63
	P	kg	57.85
	K	kg	21.99
	Micronutrient	kg	0.64
8	Irrigation	man days	03.00
9	Plant protection	lit	1.64
10	Incidental charges	rs.	651.78
OUTPUT			
11	Main product	qtls	12.82
12	By product	qtls	2.05

main produce of pigeon pea (grain) was 12.82 qtl.

3.3 Per Hectare Costs and Returns of Pigeon Pea Growers

The share of each item in the total cost provided is essential due to economizing costs. The cost has been determined based on standard cost concepts i.e. costs as Cost A₁, Cost A₂, Cost B₁, Cost B₂, Cost C₁, Cost C₂, and Cost C₃. The different cost concepts have different utilities. Here an attempt has been made to estimate the figures of cost of pulses presented in Table 2.

Per hectare costs and returns of pigeon pea were calculated and presented in Table 2. It was observed from the table that Cost-C₂ was ₹.50548.17 in which the share of Cost-B₂ was ₹.44708.43 (88.45 %) followed by Cost-A₂ was Rs. 30053.85 (59.46 %). Among all the items of variable expenditure the major portion is contributed by hired labour, machine labour and family labour to the tune of 12.18 %, 11.71 % and 11.55 % respectively. The cost of hired labour was ₹. 6157. In case of fixed expenses

the rental value of land contributed major portion of the fixed cost i.e. 26.36 %. Other items such as phosphorus application, plant protection, incidental charges, interest on working capital and depreciation contributes 3.47 %, 5.03 %, 1.31 %, 2.69 % and 5.28 % respectively.

After the rental value of land and human labour, the major contributing input in total cost was machine observed highest, the cost of machine was ₹. 5916.67 and it's share was 11.71 %. Whereas cost of plant protection also high cost was ₹. 2546.24 and it's share was 5.03 %. The utilization of pigeon pea seed was optimum and share of seed cost is ₹. 4128.20 (2.86%). The interest on fixed capital cost was ₹. 1332.23 (2.64 %) The total cost of cultivation (Cost 'C₂') of pigeon pea was ₹. 50548.17 per hectare. Cost "B₂" which include indirect expenses and cost "B₂" was ₹. 44708.43 and share is 88.45%.

3.3 Per Hectare Profitability of Pigeon Pea Cultivation

Per hectare profitability in pigeon pea production was calculated and presented in Table 3. It was

observed from the table the main produce produced was 12.82 qtl. and by produce was 2.05 qtl. Per quintal average price of pigeon pea was ₹. 6198.58. Gross returns were ₹. 84345.37 in which main produce was of ₹. 79465.90 and by produce ₹. 4919.02 It was evident from the table that per hectare net profit from pigeon pea cultivation crop was gained ₹. 33797.20. The farm business income was calculated by subtracting Cost-A₂ from Gross returns which came to ₹. 54291.52 likewise family labour income was ₹. 39636.93.

It was evident from the Table 3. that, the net profit from pigeon pea cultivation was gained ₹. 33797.20. The study revealed that, proper implementation of better production technology and proficient utilization of required inputs resulted the secure highest net profit. Hence the cost benefit ratio was highest i.e. 1.67. These finding are in the covenant with the findings of Sonwane *et al.* (2019). Per quintal cost of production of pigeon pea was ₹. 4008.57 and Output-Input ratio was 1.67.

The age, experience and sound of technical knowledge with efficient use of available inputs

proved that pigeon pea growers are technical and economically efficient in producing the desired out come from the farm enterprise and confines the second hypothesis of the study.

The age, experience and sound of technical knowledge with efficient use of available inputs proved that pigeon pea growers are technical and economically efficient in producing the desired out come from the farm enterprise and confines the second hypothesis of the study.

3.4 Cost and Returns of the Pigeon Pea Crop on the Basis of Cost Concept

Costs and return based on cost concept in pigeon pea production were provided in Table 4. Overall on an average Cost-A₁, Cost-A₂, Cost-B₁, Cost- B₂, Cost-C₁, Cost-C₂ and Cost-C₃ were worked out to ₹. 30053.85, ₹. 30053.85, ₹. 31386.08, ₹. 44708.43, ₹. 37225.82, ₹. 50548.17, ₹. 55309.94 per hectare respectively on the sampled farms. Farm business income which represents returns over cost A₂ were same as returns over variable cost as there was no difference between cost A₁ and A₂ because the leasing in land for pigeon pea production was not in practice in the study area.

Table 2. Per hectare costs and returns of pigeon pea growers

Sr. no	Particulars	Unit	Amount	Percentage
1	Cost A₁			
	Hired male	man day	2409.10	4.77
	Hired female	man day	3747.90	7.41
	Bullock power	pair day	1919.19	3.80
	Machine	hour	5916.67	11.71
	Seed	kg	1448.20	2.86
	Manures	tons	2895.54	5.73
	Fertilizers			
	N	kg	880.68	1.74
	P	kg	1756.02	3.47
	K	kg	615.00	1.22
	Total	kg	3251.72	6.43
	Micronutrient	kg	325.00	0.64
	Irrigation	man day	851.75	1.67
	Plant protection	lit	2546.24	5.03
	Incidental charges	rs.	661.78	1.31
	Working capital		25961.56	51.36
	Interest on working capital	rs.	1361.45	2.69
	Depreciation charges	rs.	2667.60	5.28
	Land Revenue	rs.	63.23	0.13
	Cost – A₁	rs.	30053.85	59.46
2	Cost A₂ (Cost A₁ + Rent paid for leased in land)		30053.85	59.46
	Interest on fixed capital	rs.	1332.23	2.64

Sr. no	Particulars	Unit	Amount	Percentage
3	Cost B₁ (Cost A₁ + Interest on fixed capital)		31386.087	61.10
	Rental value of Land	rs.	13322.35	26.36
4	Cost-B₂ (Cost B₁ + Rental value of Land)		44708.43	88.45
	Family labour			
	Male	mandays	3030.30	5.99
	Female	mandays	2809.43	5.56
5	Cost C₁ (Cost B₁ + Imputed value of family labour)		37225.82	72.65
6	Cost C₂ (Cost B₂ + Imputed value of family labour)		50548.17	100.00
7	Cost C₃ = Cost C₂ + 10 % of Cost C₂		55309.94	

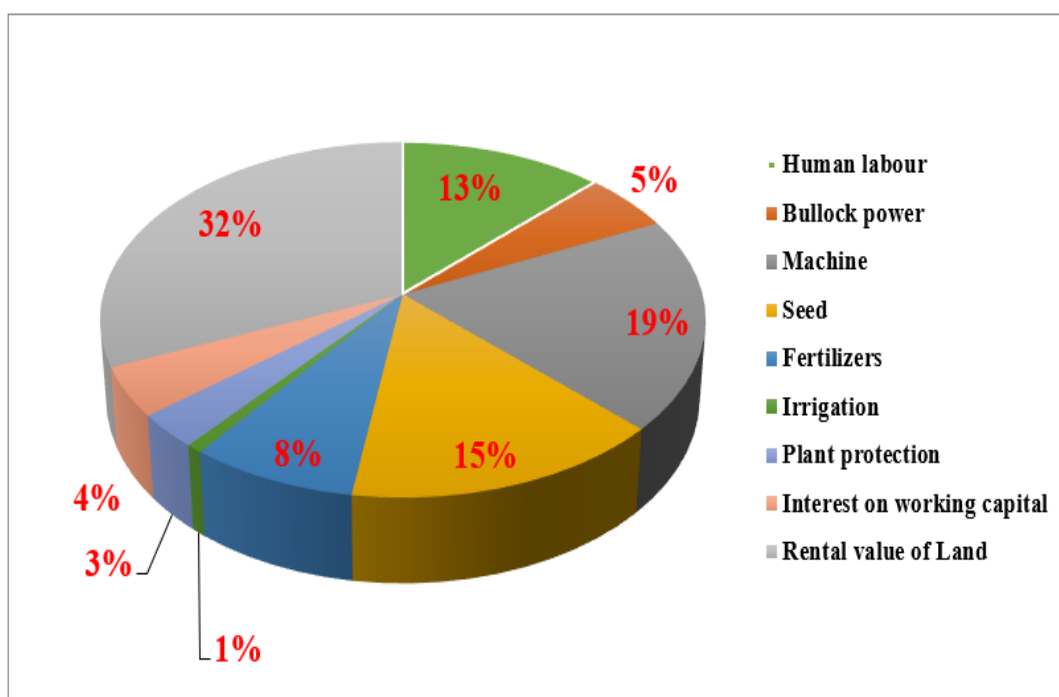


Fig 1. Percentage of expenditure in pigeon pea production to Cost- C₂ (Rs. 50548.17)

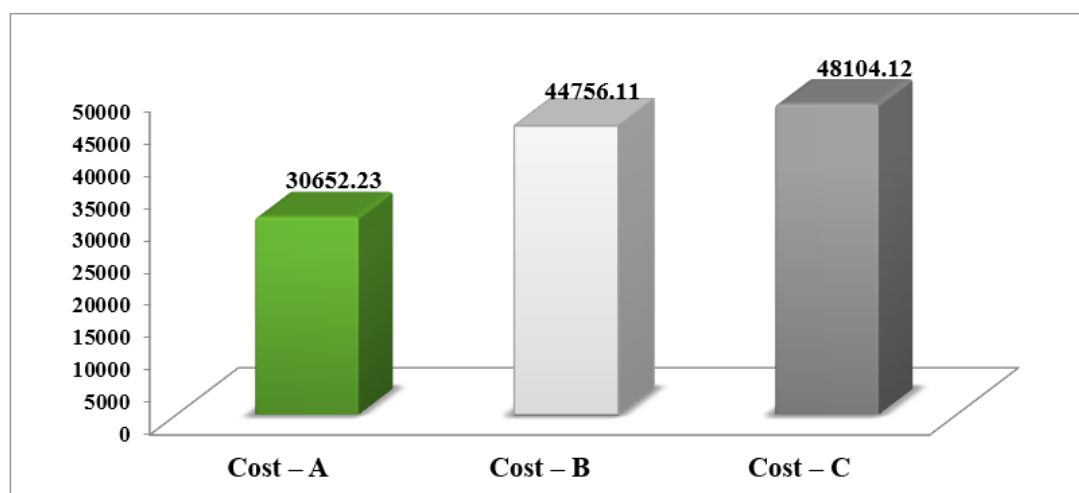


Fig 2. Expenditure in pigeon pea production

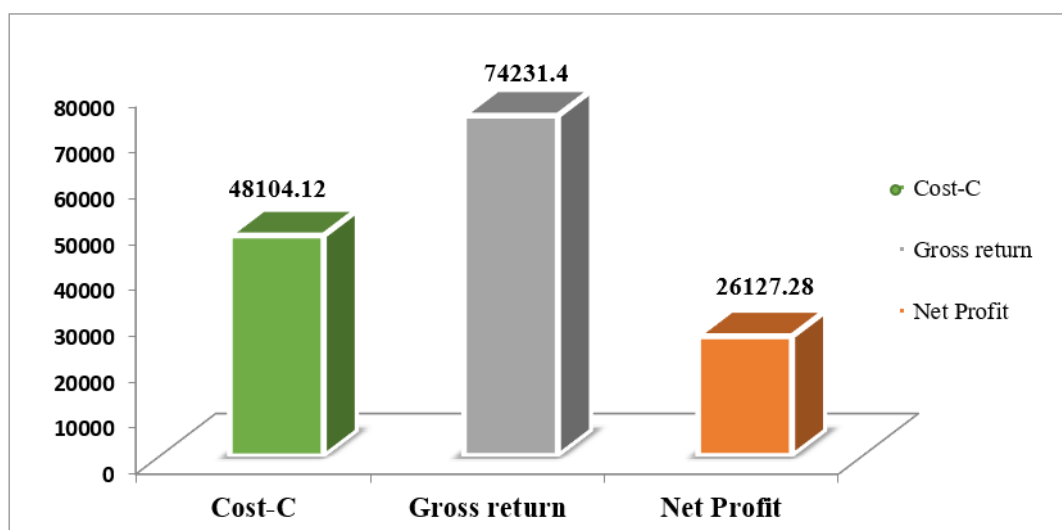


Fig 3. Per hectare profitability on pigeon pea farm (Value in Rs./ha)

Table 3. Per hectare profitability of pigeon pea cultivation

Sr. no	Particulars	Amount
1	Return from main produce	79465.90
2	Return from by-produce	4919.02
3	Gross return	84345.37
4	Cost-A ₂	30053.84
5	Cost-B ₂	44708.43
6	Cost-C ₂	50548.17
7	Farm Business Income (Gross returns minus Cost- A ₂)	54291.52
8	Family Labour Income (Gross returns minus Cost-B ₂)	39636.93
9	Net Profit (Gross returns minus Cost-C ₂)	33797.20
10	Output-Input ratio (Gross returns divided by Cost-C ₂)	1.67
11	Per quintal cost of production	4008.57

Table 4. Cost and returns of the Pigeon pea crop on the basis of cost concept

Cost of Cultivation (Rs./Hectare)		
	A ₁	30053.85
	A ₂	30053.85
	A ₂ +FL	35893.58
	B ₁	31386.08
	B ₂	44708.43
	C ₁	37225.82
	C ₂	50548.17
	C ₂ Revised	51132.14
	C ₃	55309.94
Cost of Production (Rs./Qtl)		
	A ₁	2383.33
	A ₂	2383.33
	A ₂ +FL	2846.44
	B ₁	2488.98
	B ₂	3545.47
	C ₁	2952.09
	C ₂	4008.58
	C ₂ Revised	4054.89
	C ₂	4386.20

The cost of production of pigeon pea per quintal is given in Table 4. It reveals that on an average, ₹. 4008.58 was spent on producing a quintal of pigeon pea on Cost C₂ basis. The cost of production on Cost C₃ basis was ₹. 4386.20, while on Cost A₁, Cost A₂, Cost B₁, Cost B₂, basis, ₹ 2383.33, ₹.2383.33, ₹.2488.98, ₹. 3545.47 respectively.

4. CONCLUSION

It was observed that the main produce produced was 12.82 qtl. and by produce was 2.05 qtl. Per quintal average price of pigeon pea was Rs. 6198.58. Gross returns were Rs.84345.37 in which main produce was of Rs.79465.90 and by produce Rs. 4919.02. The per hectare net profit from pigeon pea cultivation crop was gained Rs.33797.20. The farm business income was calculated by subtracting Cost-A₂ from Gross returns which came to Rs.54291.52 likewise family labour income was Rs.39636.93.

The net profit from pigeon pea cultivation was gained Rs. 33797.20. The study revealed that, proper implementation of better production technology and proficient utilization of required inputs resulted the secure highest net profit. Hence the cost benefit ratio was highest i.e. 1.67. Cost of production of pigeon pea was Rs.4008.57/qtl and Output-Input ratio was 1.67.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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