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### Cost and returns of onion under different cultivation methods

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#### Abstract

Onion is a noteworthy member of the vegetable family exemplify the significance of horticultural crops in daily life. An economic study of cost and returns of onion under different cultivation methods, broadcasting, line sowing and transplanting method. Primary data was collected from eighty onion farmers from Ballari and Koppal districts of Karnataka. Cost and returns were calculated along with Cobb Douglas production function and Garret ranking for the constraints were estimated. It was evident that the cost of cultivation and the gross returns per acre under the transplanted method was higher (₹55,491/, ₹1,84,742) as against the line sowing method (₹40,294, ₹99,996) and the broadcasting method (₹37,257, ₹64,492). It was evident that the average yield of onion under the transplanting method was higher (138.59 q/acre) compared to the line sowing (115.36 q/acre) and broadcasting (93.12 q/acre) methods. There is a need to popularize the transplanting method among the farmers of the study area with the help of KVK's and, other line departments by organizing field days and demonstrations.

**Keywords:** Onion, broadcasting, line sowing, transplanting

#### Introduction

Vegetables are among the most commonly cultivated horticultural crops due to their rich nutritional value and culinary versatility. Onion, a noteworthy member of the vegetable family, exemplify the significance of horticultural crops in daily life.

Onions can be cultivated in a variety of soil types and temperatures. They can grow from seeds or onion sets, which are tiny bulbs. It needs sandy loam soil that drains well and has a high organic content in order to be grown. To maintain a constant moisture level throughout the course of the growth cycle, adequate irrigation, whether by drip or furrow systems, is necessary. The crop benefits from a balanced fertilizer treatment that includes organic matter, nitrogen, phosphorus, and potassium. Control of weeds, pests, and diseases, for which integrated measures and strategies are essential. The tops are harvested as they start to dry up and fall over, and they are then properly dried and stored in cool, well-ventilated environments to avoid spoiling and increase shelf life.

While growing onions has many potentials, to maximize yields and profitability, farmers need to take into account elements including soil quality, climate, irrigation, and pest management. The great potential that onion farming provides may be tapped with careful planning and contemporary production methods. If the production of

onions is carried out effectively, with proper management of the resources at hand, then onion agriculture may be economically profitable. The objective of the study is to analyse the cost and returns of onion production using the three different methods *viz.*, broadcasting, line sowing and transplanting method.

Broadcasting method is a traditional method of sowing seeds, where the seeds are scattered evenly over the entire planting area without distinct rows or furrows. It is simple and requires minimal equipment. Line sowing method involves placing onion seeds in straight rows or furrows with uniform spacing between them. This method provides better control over plant spacing and easier weed management. Transplanting method involves growing onion seedlings in separate nursery beds, and or buying the seedlings, and then transplanting them into the main field. This method provides better control over plant spacing, resulting in larger, and more uniform onions.

#### Materials and Methods

In the present review and relevant information, primary data was collected from eighty onion farmers *i.e.*, thirty farmers practicing broadcasting and line sowing method each and twenty farmers who had adopted transplanting method during 2022-23.

The study was carried out in Ballari and Koppal districts of

Kalayana-Karnataka region of Karnataka state, as Ballari stand out as a key centre in the region with significant 1,30,454 tonnes of onion production yielding with productivity rate of 6948 kg/ha and Koppal ranks second with 75,972 tonnes of onion with a yielding with a production rate of 7,469 kgs/ha.

To estimate the cost, and returns of onion under different cultivation methods in the study area, eighty sample farmers were considered for the study, forty each from Ballari and Koppal. The snowball technique was adopted to identify the onion farmers in the study area. Broadcasting and Line sowing method were adopted by large number of farmers, so thirty farmers each were selected for the study. The transplanting method was not adopted in a huge number of farmers in the study area hence, only twenty farmers were selected for the study (Table 1). All the relevant data was procured using personal visits and a well-structured schedule.

The collected data were analyzed using various tools of analysis to fulfil the stated objective to arrive at useful conclusion. Tabular representation was employed to study the general economic characteristics. The statistical methods of analysis utilized to fulfil the objective of the study are explained below.

### Cost concepts

The cost of onion cultivation under different methods was estimated using standard cost concepts used in farm management studies to determine if the price received could cover the total cost of the production of onion. Cost of cultivation includes variable costs and fixed costs.

### Variable costs

This included the expenses incurred on human labours, machinery labour, manure, chemical fertilizers, seeds/bulbs, manures, fertilizers, herbicides, plant protection chemicals, and interest in working capital.

### Fixed costs

1. Depreciation on tools, implements, and machinery: The depreciation was calculated using the formula below, taking into account the expected remaining life of various implements, hand tools as well and irrigation materials.

$$\text{Annual depreciation} = \frac{(\text{Present value} - \text{junk value})}{\text{Expected life of the asset}}$$

2. Rental value of land: The average rent paid or rent prevailing in the locality (if rented) was considered as the rental value of the land.
3. Land revenue: The land revenue was included in this cost, which was paid by the cultivators.
4. Interest in fixed capitals: It was calculated at a rate of 9 percent per annum on the fixed capital based on prevailing interest rates for term loans in commercial banks.

### Cost of production

It is calculated by using the formula;  
Total quantity of product

$$\text{Cost of production} = \frac{\text{Cost of cultivation}}{\text{Total quantity of product}}$$

**Gross income:** It represents the total amount of money earned or received from a particular activity without considering the associated costs or deductions.

It is the total value of a main product as well as of a by-product.

$$GI = (Q \times P)$$

Where,

GI = Gross income

Q = Quantity of product

P = Price of the product

### Returns over variable cost (RVC)

It can be referred to as returns above variable costs or gross margin.

$$RVC = \text{Gross income} - \text{Variable cost}$$

**Net income (NI):** Net income is obtained by deducting the total costs incurred from the gross income realized by the onion producer.

$$NI = \text{Gross income} - \text{Cost of cultivation}$$

### Returns per rupee of investment

It is expressed as a percentage, calculated by dividing profit by its cost or outlay.

Total cost of cultivation

$$ROI = \frac{\text{Gross income}}{\text{Total cost of cultivation}}$$

### Results and Discussion

The information acquired on the production aspects regarding to the cost and returns of onion cultivation within the chosen study and different production technique's cost and returns were explored. Item wise cost incurred on different inputs in cultivation of onion under broadcasting, line sowing and transplanting method have been presented in Table 1. It was evident that the cost of cultivation under the transplanted method was higher (₹55,491/acre) as against the line sowing method (₹40,294/acre) and the broadcasting method (₹37,257/acre).

The per acre cost incurred on human labour (₹20,531) and seeds (₹14,589) was comparatively higher in the transplanting method as compared to broadcasting (₹14,572 and ₹5,077) and line sowing (₹17,008 and ₹4,534) methods. The same pattern was observed in the cases of per acre costs incurred on bullock labour in the transplanting method (₹1,545), in the line sowing method (₹1,500), and in the broadcasting method (₹1,211). The per acre cost of manures and fertilizers was also higher in the transplanting method (₹5,244 and ₹2,461), as the requirement of plant nutrients (1.50t of manure and 4.07 q of fertilizers) was also higher than in the broadcasting method (1.10t of manure and 3.82q of fertilizers) and the line sowing method (1.27t of manure and 4.02q of fertilizers). The same kind of results was observed by Priyanka (2012)<sup>[3]</sup> and Bhagwan (2017)<sup>[2]</sup>.

The Table 1 clearly illustrates that the expenditure on herbicides was higher in the broadcasting method, amounting to ₹863/acre, which involved the use of 202.56 ml/acre of herbicides. This is in contrast to the line sowing method, where the cost was ₹733 for 186.34 ml/acre of herbicides, and transplanting, which incurred a cost of ₹676 for 179.33 ml/acre of herbicides. Weed occurrence was typically lower in the transplanting method compared to both broadcasting and line sowing methods. This is because onion seedlings were established before they were planted in the field. Additionally, the transplants were arranged in

rows, simplifying the manual management and control of weeds. It can be concluded that farmers need to adopt judicious and responsible herbicide application practices that consider both weed control and the overall health of the crop and its surrounding ecosystem. In direct-seeded methods (broadcasting and line sowing methods), pre-emergence weeding can be performed with herbicides, and for transplanted onion, herbicides can be applied before or after planting at appropriate growth stages to avoid crop injuries (Sekara *et al.*, 2017 and Modi *et al.*, 2022)<sup>[4, 1]</sup>.

**Table 1:** Cost of cultivation of onion under different methods

Sl. No.	Particulars	Broadcasting		Line sowing		Transplanting	
		Quantity	Value	Quantity	Value	Quantity	Value
<b>I. Variable cost</b>							
1.	Labour cost (Mandays)	45.5	14572 (39.11)	48.5	17008 (42.21)	57	20531 (37.00)
a.	Men	18	7108	21	8608	27	11016
b.	Women	22	6113	22	8400	24	9515
2.	Bullock (PD)	1.3	1211 (3.25)	1.24	1500 (3.72)	1.45	1545 (2.78)
3.	Machine labour (Hrs.)	1.10	986 (2.65)	1.35	1094 (2.72)	1.40	1019 (1.84)
4.	Seed/Bulbs (Kgs/No.)	5.70	5077 (13.63)	4.20	4534 (11.25)	2,70,000	14589 (26.27)
5.	Manure (t)	1.10	3869 (10.38)	1.27	4476 (11.11)	1.50	5244 (9.45)
6.	Fertilizers (Q)	3.82	2076 (5.57)	4.02	2319 (5.76)	4.07	2461 (4.46)
7.	P.P chemicals (gms/mls)	3.15	1408 (3.78)	3.45	1216 (3.02)	3.25	1010 (1.82)
8.	Herbicides(ml)	202.56	863 (2.32)	186.34	733 (1.82)	179.33	676 (1.22)
9.	Interest on working capital (7%)	-	2104 (5.65)	-	2302 (5.71)	-	3295 (5.94)
	Total variable cost	-	32166 (86.34)	-	35182 (87.31)	-	50361 (90.75)
<b>II. Fixed cost</b>							
1.	Rental value of land	-	3616 (9.71)	-	3608 (8.95)	-	3608 (6.50)
2.	Land revenue	-	134 (0.36)	-	130 (0.32)	-	118 (0.21)
3.	Depreciation	-	920 (2.47)	-	952 (2.36)	-	981 (1.77)
4.	Interest on fixed capital (9%)	-	420 (1.13)	-	422 (1.05)	-	424 (0.76)
	Total fixed cost	-	5091 (13.66)	-	5111 (12.69)	-	5129 (9.25)
III.	Total cost (I+II)	-	37257 (100.00)	-	40294 (100.00)	-	55491 (100.00)

The transplanting method had the highest total variable cost per acre (₹50,361), followed by line sowing (₹35,182) and broadcasting (₹32,166). It was because the transplanting method, which frequently requires more labour-intensive work and high quality seedlings compared to the other two methods, entails substantially higher labour and seedling costs. The seedlings are typically grown in nurseries before being transplanted to the field, which adds to the costs, and the requirement of seeds per unit area is greater in the transplanting method than line sowing or broadcasting. Though transplanting may have higher variable costs, it might still be the preferred method as it offers advantages such as better plant establishment and weed control in the studied area.

The per acre fixed costs for the three different onion cultivation methods were also calculated, and the results indicated that the broadcasting method incurred fixed costs of ₹ 5,091, line sowing amounted to ₹ 5,111, and transplanting had fixed costs of ₹ 5,129. These fixed costs represent the expenditures that remain constant regardless of the scale of production or the size of the cultivated area. Even though the fixed costs were relatively close in value among the three methods, they play a crucial role in the overall economics of onion farming, influencing the decision-making process for farmers when choosing their preferred onion cultivation method. The details of the cost and return structure of onion under different cultivation

methods are presented in Table 2. It was evident that the average yield of onion under the transplanting method was higher (138.59 q/acre) compared to the line sowing (115.36 q/acre) and broadcasting (93.12 q/acre) methods. Gross income per acre received was highest in transplanting (₹1,84,742) than in line sowing (₹99,996) and broadcasting (₹64,492) methods. Even the net income per acre received followed the same pattern, transplanting (₹1,29,521), line sowing (₹59,702), and broadcasting (₹27,325) method.

The transplanting method offered the best returns per rupee invested with a ratio of 3.34, followed by the line sowing method with a ratio of 2.48 and the broadcasting approach with a ratio of 1.74. This means that the transplanting method outperformed and surpassed the traditional methods such as broadcasting and line sowing methods of onion cultivation. This occurred as a result of the transplanting method's ability to place well-established onion seedlings precisely, resulting in ideal spacing and higher plant densities which in turn led to enhanced yields per unit area. Additionally, because the seedlings were established prior to planting, the transplanting approach often provides greater weed management, lowering the weed competition and improving the general health of onion plants. Higher yields in onion transplanting were also attributed to the absence of thinning activity, a labour-intensive process in the direct seedling (broadcasting and line sowing), and the uniformity of plant growth.

**Table 2:** Cost and returns of onion under different cultivation methods

Sl. No.	Particulars	Methods of cultivation		
		Broadcasting	Line sowing	Transplanting
1.	Production (q/acre)	93.12	115.36	138.59
2.	Total quantity sold (q/acre)	72.22	95.69	124.91
3.	Average price (₹/q)	893	1045	1479
4.	Gross income (₹/acre)	64492	99996	184742
5.	Total cost (₹/acre)	37257	40294	55491
6.	Net income (₹/acre)	27325	59702	129251
7.	Returns over variable cost (₹/acre)	36022	68832	139032
8.	Cost of production (₹/q)	516	421	444
9.	Net income (₹/q)	377	624	1035
10.	Returns per rupee of investment	1.74	2.48	3.34

In terms of revenue and quality product in the study area, the transplanting method was more lucrative as a result of these benefits added together. The farmers in the research region suggested this method should be promoted that the farming community should receive the appropriate government assistance to allow for early maturity and harvest, which might result in higher prices while also reducing the risk of seed loss.

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### Conclusion

In the study area, most of the farmers engaged the direct sowing methods of onion cultivation as compared transplanting method. In the economic study of cost of cultivation of onion under three different methods, the total cost of cultivation per acre was found to be higher in the transplanting method (₹55,491) than in the line sowing (₹40,294) method and broadcasting (₹37, 257) method. The benefit-cost ratio worked out to be higher in the transplanting method (3.34), which was followed by the line sowing method (2.48) as compared to the broadcasting method (1.74). The yield and returns in the transplanting method were higher as it enables early harvesting and the quality of bulbs is of better quality with large size of onion bulb. Hence, there is a need to popularize the transplanting method among the farmers of the study area with the help of KVK's and, other line departments by organizing field days and demonstrations.

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