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## Economics of different greengram cultivars in North Karnataka

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#### Abstract

The present study in North Karnataka focused on Gadag and Dharwad districts based on the highest area under green gram cultivation. Total sample size of 128 farmers cultivating different varieties of green gram were sampled. Three principal varieties of green gram were cultivated in the study area. They were DGGV-2, BGS-9 and NVL<sup>-1</sup>. When comparing the net returns generated by different varieties, the net returns from the cultivation of DGGV-2 was Rs.42,872 per ha, which is substantially high compared to that of BGS-9 and NVL<sup>-1</sup> existing green gram varieties (Rs. 24,252/ha and Rs.34,988/ha, respectively), along with these returns per rupee of investment was also higher in case of DGGV-2 (1.80), when compared to NVL-1 (1.63) and BGS-9 (1.43), respectively. Hence, there is a need to popularize the good varietal traits of the DGGV-2 released by the University of Agricultural Sciences, Dharwad through frontline demonstrations by the State Department of Agriculture.

**Keywords:** BGS-9, DGGV-2, NVL-1, cost, returns

#### Introduction

Greengram (*Vigna radiata*) is one of India's most valuable pulse crops. Greengram is a native of India and Central Asia and has grown in these regions since prehistoric times. Greengram is widely cultivated throughout Asia, including India, Pakistan, Bangladesh, Sri Lanka, Thailand, Laos, Cambodia, Vietnam, Indonesia, Malaysia, and Formosa. India contributes more than 70 percent of world's greengram production, while its cultivation has spread to Africa and America relatively in the recent times. Greengram is an annual herb with a height of 45 to 75 cm that belongs to the Leguminosae family. It is an erect to sub-erect, deep-rooted, heavily branched, and very hairy annual herb. Plants are usually branched, and the cultivated types habits range from erect to sub-erect. The stem is furrowed, squarish, and hairy with green and purple pigmentation, and the root system is an extensive taproot. Nodules on the roots fix atmospheric nitrogen through a symbiotic relationship with the bacterium *Rhizobium*. When mature, the pod colour ranges from brown to light grey.

Greengram contains high-protein around 24 to 25 percent, which is almost three times that of cereals and low-carbohydrate staple food. It meets the protein needs of the country's vegetarian population. Hence greengram is also called as vegetarian meat and it is an essential source of vegetarian nutrition. Greengram is also been used as a cattle feed even husk of the seed can be soaked in water and used as feed for cattle, thus is an important source of animal nutrition. In addition to that greengram helps to maintain soil fertility by enhancing soil physical properties and fixing atmospheric nitrogen. It is a drought-resistant crop that is well-suited to dryland farming.

Greengram is best suited to areas having an annual rainfall of 60 to 75 cm. It requires a hot and warm climate. Greengram is considered to be hardiest among all pulse crops and can tolerate drought to a great extent. Hence, it is successfully grown in any adverse conditions and particularly in drought prone areas during *kharif* season. However, water logging and cloudy weather are harmful for the crop.

In India, important of pulses cultivated are greengram, pigeon pea, chickpea, black gram, lentil, and peas. Pulses are grown on 27.98 million ha, producing 23.02 million tonnes and yielding 823 kg per ha on average. Indian farmers have covered 134.02 lakh ha under *kharif* pulses as on 27<sup>th</sup> September 2019 as against 136.40 lakh ha last year. Around 31.15 lakh ha was covered under greengram, while the same was 34.24 lakh ha last year. The states of Rajasthan (18.30 lakh ha), Maharashtra (3.28 lakh ha) Karnataka (2.69 lakh ha), Madhya Pradesh (1.82 lakh ha), Odisha (1.63 lakh ha) and Telangana 0.70 lakh ha) are the major producers of greengram in India (Anonymous, 2018).

In Karnataka, major growing district is Gadag stands in first position with the production of 24,170 tonnes and area of 1,40,566 hectares followed by Dharwad with an area of 59,344 hectares with production of 20,800 tonnes and Belagavi district with the production of 30,176 tonnes with an area of 54,955 hectares and Bagalkot district with the production of 8,534 tonnes with the area of 40,834 hectares (Karnataka State at a Glance, 2018-19).

Therefore, the present study is undertaken in North Karnataka considering its significance in terms of area and production. The research and development initiatives from time to time play an important role in enhancing the productivity of the crop. There are many genotypes released by research institution and are being cultivated by farmers. The present study attempts to analyse the varietal impact assessment of green gram cultivation in North Karnataka.

## Materials and Methods

### Study area

Multistage purposive sampling technique was employed for selection of districts, taluks, villages and sample farmers. In the first stage, Gadag and Dharwad districts were selected for the study based on highest area under greengram cultivars. In the second stage, based on maximum area under greengram cultivation, two taluks namely Gadag and Ron from Gadag district and two taluks namely Dharwad and Navalgund from Dharwad district were chosen for the study. In the third stage also, two villages from each taluk based on highest area under greengram cultivars were selected. In the fourth stage, sixteen farmers were selected from each village comprising eight sample farmers who are growing University released greengram cultivars (DGGV-2) and eight farmers who are growing other greengram cultivars (BGS-9 and NVL-1) in the study area. Thus, total sample size comprising of 128 farmer respondents. The primary data needed for the study was collected from the farmers by a personal interview method using a pre-tested schedule.

### Period of study

Taking into consideration the purpose and data requirement of the study, the period of study was restricted to the good agricultural year 2021-2022 (Normal year) with normal rainfall, which is sufficient for undertaking an in-depth study of the research problem.

### Analytical tools and techniques used

- 1. Descriptive Statistics:** Descriptive statistics such as frequency and percentage were used to analyse the perception of farmers on varietal traits.
- 2. Applied Cost concepts:** The technique of tabular presentation was used to assess the cost, returns and profits of different varieties of greengram crops in the study area. The percentages and averages of variable costs and fixed costs were computed based on the methodology followed by the commission on agricultural costs and prices (CACP). All the cost concepts used in farm management studies viz., Cost A<sub>1</sub>, Cost A<sub>2</sub>, Cost B<sub>1</sub>, Cost B<sub>2</sub>, Cost C<sub>1</sub>, Cost C<sub>2</sub> and Cost C<sub>3</sub> were used in the present study. The details of cost concepts adopted in this study are furnished as follows:

### Cost items (In ₹)

1. Value of hired human labour

2. Value of owned bullock labour
3. Value of hired bullock labour
4. Value of owned machine labour
5. Value of hired machine labour
6. Value of owned seed
7. Value of purchased seed
8. Value of owned farmyard manure
9. Value of purchased farmyard manure
10. Value of fertilizers and insecticides
11. Irrigation charges
12. Land revenue
13. Interest on working capital
14. Depreciation
15. Miscellaneous expenses
16. Rent paid for leased in land
17. Interest on fixed capital
18. Rental value of owned land
19. Imputed value of family labour

Cost A<sub>1</sub>: Items 1 to 15

Cost A<sub>2</sub>: Cost A<sub>1</sub> + Rent paid for leased in land

Cost B<sub>1</sub>: Cost A<sub>1</sub> + Interest on fixed capital

Cost B<sub>2</sub>: Cost B<sub>1</sub> + rental value of owned land + rent paid for leased in land

Cost C<sub>1</sub>: Cost B<sub>1</sub> + Imputed value of family labour

Cost C<sub>2</sub>: Cost B<sub>2</sub> + Imputed value of family labour

Cost C<sub>3</sub>: Cost C<sub>2</sub> + 10 percent of cost C<sub>2</sub> as management cost.

3. Cost of production (per quintal)

$$\text{Cost of production (per quintal)} = \frac{\text{Cost of cultivation (in ₹)} - \text{Value of by product (in ₹)}}{\text{Quantity of main product (in quintal)}}$$

4. Gross Incomes (G.I.)

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

$$G.I = Q_m \times P_m + Q_b \times P_b$$

Where,

G.I. = Gross income

$Q_m$  = Quantity of main product

$P_m$  = Price of main product

$Q_b$  = Quantity of by- product

$P_b$  = Price of by- product

5. Net returns

Net returns = Gross incomes - Total costs (Cost C<sub>3</sub>)

6. Benefit- Cost Ratio (B:C Ratio)

$$B:C \text{ Ratio} = \frac{\text{Total Returns}}{\text{Total Costs}}$$

7. Income measures

The following income measures were calculated,

### Farm business income

Farm business income = Gross income – Cost A<sub>2</sub>, similar approach was also practiced by Agarwal *et al.* (2018) [1].

Family labour income

Family labour income = Gross income – Cost B2

Farm Investment income

Farm Investment income = Farm business income – Imputed value of family labour

## Results and Discussion

### Costs incurred and returns realized from the different varieties of greengram

Table 1, reveals the cost and returns obtained from different varieties of greengram in the study area.

In the case of DGGV-2 an improved variety of greengram, the per hectare total cost of cultivation was Rs. 48,499 per ha consisted of operational per variable cost (Rs. 35,075 / ha) and fixed cost (Rs. 13,424 / ha). The variable cost is the maximum cost incurred in the total cost about 72.32 percent, whereas, the fixed cost has accounted for 27.67 percent. In the variable cost, human labour has accounted for 27.37 percent followed by machine labour (20.25%), chemical fertilizers (8.38%), manures (5.52%), interest on working capital (4.36%), seeds (2.86%), and plant protection chemicals (0.79%). Among the fixed cost (27.67%), the rental value of land has accounted a major share (16.75%). Similar results were reported in findings of Govinda *et al.* (2021)<sup>[5]</sup>.

Table 2, illustrates the different income categories derived by using applied cost concepts in study area.

In the case of DGGV-2 variety, gross income was found to be Rs. 96,221 per ha and the net returns over total cost was Rs. 42,873 per ha and the net returns over operational cost were Rs. 61,146 per ha, While, the average yield of 12.75 (quintals / ha) was obtained and the net returns over total cost per quintal was Rs. 3,363, net returns over total variable cost per quintal was Rs. 4,796, and correspondingly high B:C ratio (1.80) was found to be in these variety.

When compared to the costs and returns realized in respect of DGGV-2 with that of BGS-9 and NVL-1, there are very low returns from BGS-9 variety and high returns from the DGGV-2 variety due to superior varietal characters like higher yield

and resistance to various pest and disease.

In the case of BGS-9, the cost and returns realized from per hectare cost of cultivation was found to be Rs. 49,381. In this operational per variable cost accounted Rs. 35,875 per ha, with the share of 72.43 percent to the total cost of cultivation. In the variable cost, human labour as accounted for (28.39%), followed by machine labour (19.94%), chemical fertilizers (8.45%), manures (5.94%), interest on working capital (3.88%), seeds (2.75%), and plant protection chemicals (0.80%). Whereas, among the fixed cost (27.53%), the fixed costs rental value of land has accounted for a major share (16.59%).

Whereas, the gross income (Rs. 78,112/ha), and the net returns over total cost was Rs. 23,793 per ha and net returns over operational cost was Rs. 42,630 per ha While, the average yield of 10.49 (quintals/ha) was obtained, net returns over total cost per quintal was Rs. 2,268 per quintal, net returns over total variable cost per quintal was Rs. 4,064 per quintal, and the B:C ratio was 1.43.

In the overall cost of cultivation per hectare for NVL-1 existing variety of greengram was Rs. 50,761 per ha. The operational per variable cost (Rs. 38,083 / ha) estimated to account for 75.02 percent of the overall cost of cultivation. Human labour attributed for 27.49 percent of variable costs, followed by machine labour 19.41 percent, chemical fertilisers 8.67 percent, organic manures 4.06 percent, seeds accounted 5.30 percent, interest on working capital 7.34 percent, miscellaneous costs 1.84 percent, and plant protection chemicals 0.91 percent. Whereas, among the fixed costs (24.98%) rental value of land contributed the major share (16.01%).

Whereas, the gross income was Rs. 90,862 per ha along with the net returns over total cost were Rs. 34,988 per ha, net returns over operational cost was Rs. 52,779 per ha. While, average yield of 12.52 (quintals / ha) was obtained, Whereas, the net returns over total cost per quintal was Rs. 2,795 per quintal, net returns over total operational cost per quintal was Rs. 3,042 per quintal, and the B:C ratio was found to 1.63.

**Table 1:** Comparison of Cost of cultivation of different greengram varieties of greengram (Per hectare)

Sl. No.	Particulars	Cost in (Rs. /ha)		
		DGGV-2 (n=64)	BGS-9 (n=32)	NVL-1 (n=32)
		<b>Variable costs</b>		
	Seed	1,388 (2.86)	1,347 (2.75)	2,689 (5.30)
	Human labour	13,277 (27.37)	13,883 (28.39)	13,953 (27.49)
	Machine labour	9,825 (20.25)	9,783 (19.94)	9,852 (19.41)
	Manures.	2,678 (5.52)	2,912 (5.94)	3,725 (4.06)
	Chemical fertilizers	4,065 (8.38)	4,145 (8.45)	4,404 (8.67)
	PPC	385 (0.79)	390 (0.80)	464 (0.91)
	Miscellaneous expenses	1,339 (2.76)	1,514 (2.29)	969 (1.84)
	Interest on working capital at 8 percent	2,117 (4.36)	1,901 (3.88)	2,063 (7.34)
I	Total Variable costs (TVC)	35,075 (72.32)	35,875 (72.43)	38,117 (75.02)
	Land revenue	20 (0.04)	20 (0.04)	20 (0.04)
	Depreciation	3,561 (7.34)	3,615 (7.38)	2,867 (5.65)
	Interest on fixed capital at 10 percent	1,717 (3.54)	1,746 (3.56)	1,666 (3.28)
	Rental value of owned land	8,125 (16.75)	8,125 (16.59)	8,125 (16.01)
II	Total Fixed costs (TFC)	13,424 (27.67)	13,506 (27.57)	12,679 (24.98)
III	Total cost (TC=TVC+ TFC)	48,499 (100.00)	49,381 (100.00)	50,795 (100.00)

**Table 2:** Different income categories derived from applied costs (Rs. /ha) (Average per ha)

SI. No.	Particulars	Units	DGGV-2 (n=64)	BGS-9 (n=32)	NVL-1 (n=32)	Average
1.	Total cost of cultivation (Cost C <sub>3</sub> )	Rs./ha	53,348	54,319	55,874	54,514
2.	Total variable cost	Rs./ha	35,075	35,482	38,083	36,213
3.	Total fixed cost	Rs./ha	18,273	18,837	17,791	18,300
4.	Average yield	Qty./ha	12.75	10.49	12.52	11.92
5.	Average market price	Rs./q	7,217	7,090	6,984	7,097
6.	Gross income	Rs./ha	96,221	78,112	90,862	88,398
7.	Net returns over total cost	Rs./ha	42,873	23,793	34,988	33,885
8.	Net returns over total variable cost	Rs./ha	61,146	42,630	52,779	52,185
9.	Net returns over total cost	Rs./q	3,363	2,268	2,795	2,809
10.	Net returns over total variable cost	Rs. q	4,796	4,064	4,216	4,359
11.	B:C ratio		1.80	1.43	1.63	1.62

**Note:** NVL-1(Nirmal) private variety of greengram.

### Types of costs incurred in different varieties of greengram

**cultivation:** Cost A<sub>1</sub>, Cost A<sub>2</sub>, Cost B<sub>1</sub>, Cost B<sub>2</sub>, Cost C<sub>1</sub>, Cost C<sub>2</sub> and Cost C<sub>3</sub> are the cost categories, according to the commission on agricultural costs and prices in the Government of India. Since it is crucial to understand how these costs are calculated and allocated among the various greengram varieties, the relevant information is examined, and the findings are shown in Table 3.

Table 3, revealed the status of cost involvement in cultivation of greengram crop in one ha of land. When one could examine the Cost A<sub>1</sub>, it is too low in respect of DGGV-2 variety which is Rs. 33,172 / ha. Highest of Cost A<sub>1</sub> was incurred in NVL-1 variety of greengram. The average of Cost A<sub>1</sub> incurred in all the varieties is arrived at Rs. 34,098. Similar cost involvement is also reported by Govind *et al.* (2019) [5]. Similar results are obtained in respect of Cost A<sub>2</sub>, Cost B<sub>1</sub>, Cost B<sub>2</sub>, Cost C<sub>1</sub>, Cost C<sub>2</sub> and Cost C<sub>3</sub>. All these costs are comparatively low in respect of DGGV-2 variety when compared to all other varieties followed by NVL-1 variety which commanded the highest cost among all the varieties of greengram. From that one could infer that the cost of cultivation of NVL-1 variety commands higher cost and the DGGV-2 variety is capable of consuming lowest cost and generates greater returns compared to other varieties of greengram.

We can observe that B:C was found to be 1.80, 1.45 and 1.63 respectively for DGGV-2, BGS-9 and NVL-1. From this ratio we can conclude that it is financially feasible to cultivate these varieties. Our findings line up the findings of Sangamesh and Patil (2018) [2]. Where B:C ratio found to be 1.83 in greengram cultivation. In our findings it clearly shows that DGGV-2 variety was found to be more profitable than

other varieties of greengram.

### Farm income measures

The net return over variable cost is favourable in respect of DGGV-2 variety followed by NVL-1 variety which are, respectively able to generate income Rs. 61,146 per ha and Rs. 52,779 per ha. The return over variable cost is very low in respect of BGS-9 variety. However, the average variable cost is Rs. 52,185 per ha. Which is a considerable income to the farmers. Hence, the sample farmers should think of alternative variety like DGGV-2 or NVL-1 in the place of BGS-9 variety for generating higher farm incomes.

Table 4, depicts the farm income measures derived from cultivation of different varieties of greengram in study area. Farm business income refers to profits and losses incurred through operation of the farm. A farm income statement is a summary of income and expenses that occurred during a specified accounting period. The farm business income was found to be higher in DGGV-2 and NVL-1 varieties which are respectively accounted for Rs. 63,049 and Rs. 55,331. In respect of farm business income also, the BGS-9 variety is capable of generating comparatively lower return (Rs. 42,630). Family labour income is the income to be generated from the farm because of their active involvement in crop production. Because of the family labour participation in the farm operations, the hired wage labour will equally be contributing to the productivity of the farm and hence, the income in general could be enhanced. In this respect, the family labour income was assessed and the income is favourable in respect of DGGV-2 variety and NVL-1 variety of greengram. Both of the varieties are capable of contributing to an average family labour income Rs. 56.963 per ha.

**Table 3:** Cost structure of different green gram varieties

SI. No.	Particulars	Cost (Rs. /ha)		
		DGGV-2 (n=64)	BGS-9 (n=32)	NVL-1 (n=32)
1	Value of hired human labour	7,793 (14.60)	8,164 (15.03)	8,281 (15.23)
2	Value of hired machine labour	9,825 (18.41)	9,783 (18.01)	9,852 (18.12)
3	Value of purchased seed	1,388 (2.60)	1,347 (2.48)	2,689 (4.94)
4	Value of owned farmyard manure	303 (0.56)	393 (0.72)	497 (0.91)
5	Value of purchased farmyard manure	2,678 (5.01)	2,912 (5.36)	3,725 (6.85)
6	Value of Chemical fertilizers and PPC	4,451 (8.34)	4,535 (8.35)	4,404 (8.10)
7	Land revenue	20 (0.03)	20 (0.03)	20 (0.03)
8	Interest on working capital at 8 percent	2,117 (3.96)	1,901 (3.50)	2,063 (3.80)
9	Depreciation	3,561 (6.67)	3,615 (6.65)	2,867 (5.27)
10	Miscellaneous expenses	1,036 (1.94)	1,121 (2.06)	935 (1.72)
I	Cost A <sub>1</sub>	33,172 (62.18)	33,791 (62.21)	35,331 (65.00)
II	Cost A <sub>2</sub> = Cost A <sub>1</sub> + Rent paid for leased in land	33,172 (62.18)	33,791 (62.21)	35,331 (65.00)
11	Interest on fixed capital at 10 percent	1717 (3.21)	1,746 (3.21)	1,666 (2.98)

III	Cost B <sub>1</sub> = Cost A <sub>2</sub> + Interest on fixed capital	34,889 (65.39)	35,537 (65.42)	36,998 (66.21)
12	Rental value of owned land	8,125 (15.23)	8,125 (14.96)	8,125 (14.54)
IV	Cost B <sub>2</sub> = Cost B <sub>1</sub> + Rental value of owned land	43,014 (80.62)	43,662 (80.38)	45,123 (80.75)
14	Imputed value of family labour	5,484 (10.27)	5,719 (10.53)	5,672 (10.15)
V	Cost C <sub>1</sub> = Cost B <sub>1</sub> + Imputed value of family labour	40,374 (75.68)	41,256 (75.95)	42,670 (76.36)
VI	Cost C <sub>2</sub> = Cost B <sub>2</sub> + Imputed value of family labour	48,499 (90.81)	49,381 (90.91)	50,795 (90.90)
15	Management cost (10% of Cost C <sub>2</sub> )	4,849.90 (9.09)	4,938.10 (9.09)	5,079.50 (9.09)
VII	Cost C <sub>3</sub> = Cost C <sub>2</sub> + Management cost <i>i.e.</i> , 10% of Cost C <sub>2</sub>	53,348 (100.00)	54,319 (100.00)	55,874 (100.00)

**Note:** NVL-1 (Normal) private variety of greengram, figures in parentheses indicate percentage to Cost C<sub>3</sub>

**Table 4:** Farm income measures derived from cultivation of different greengram varieties (Rs. per ha)

SI. No.	Particulars	Units	DGGV-2 (n=64)	BGS-9 (n=32)	NVL-1 (n=32)	Average
1.	Farm business income	Rs. / ha	63,049	44,321	55,531	54,300
2.	Family labour income	Rs. / ha	53,207	34,450	45,739	44,465
3.	Farm investment income	Rs. / ha	57,564	38,602	49,859	48,675
4.	Farm business income	Rs. / q	4,945	4,225	4,435	4,535
5.	Family labour income	Rs. / q	4,173	3,284	3,653	3,703
6.	Farm investment income	Rs. / q	4,517	3,680	3,980	4,059

**Note:** NVL-1(Normal) private variety of greengram.

### Conclusions and policy implications

The present study has attempted to highlight the cost incentives associated with different greengram varieties. The gross returns obtained in per hectare cultivation of greengram is found to be highest and in favour of DGGV-2 and NVL<sup>-1</sup> varieties. The low return from BGS-9 variety when compared to their counterparts is mainly because of low procurement price from the farmers and in the market, it commands less price and preference over other varieties. The greengram varieties are offering a different rate of return per rupee of investment. The return per rupee of investment is also in the favour of DGGV-2 and NVL<sup>-1</sup> varieties of greengram. Hence, measures may be taken of in order to supply improved variety (DGGV-2) seeds at right time with right quantity to farmers through Raith Samparaka Kendras (RSKs) and National Seed Corporation (NSC). And also, there is a need to create awareness among the farmers and also extension activities that actually reach the farming community through various mass media and also through frontline demonstrations by state department of agriculture. So that farming community growing greengram would be in the beneficial side.

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