ECONOMICS OF SEED PRODUCTION OF SELECTED FOOD GRAINS IN KARNATAKA

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DEPARTMENT OF AGRICULTURAL ECONOMICS

UNIVERSITY OF AGRICULTURAL SCIENCES

BENGALURU - 560 065

2018

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Thesis submitted to the

UNIVERSITY OF AGRICULTURAL SCIENCES, BENGALURU

in partial fulfillment of the requirements

for the award of the degree of

MASTER OF SCIENCE (Agriculture)

in

AGRICULTURAL ECONOMICS

BENGALURU AUGUST, 2018

Affectionately Dedicated to

My Beloved

Parents, Friends &

Seed producers

DEPARTMENT OF AGRICULTURAL ECONOMICS
UNIVERSITY OF AGRICULTURAL SCIENCES
GKVK, BENGALURU - 560 065

CERTIFICATE

This is to certify that the thesis entitled **"ECONOMICS OF SEED PRODUCTION OF SELECTED FOOD GRAINS IN KARNATAKA"** submitted by **Ms. THEJASHREE, H. N., ID No. PALB 6121** in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL ECONOMICS** to the University of Agricultural Sciences, GKVK, Bengaluru is a record of *bona-fide* research work done by her during the period of her study in this University under my guidance and supervision and the thesis has not previously formed the basis for the award of any other degree, diploma, associate ship, fellowship or other similar titles.

Bengaluru
August, 2018

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ACKNOWLEDGEMENT

"A journey is easier when you travel together. Interdependence is especially more valuable than independence". At the every outset, I express my deep sense of indebtedness and humblest salutation at the golden feet of my parents whose love, trust and confidence in me deposed at every moment of this rather strenuous career, provided me the courage that was so vital to sustain the ferry moments of the educational exercise. I owe my success to my mother **Smt. Siddalingamma, P. V**, father **Sri. Natarju, H. K,** brother **Sharath, sister in law Gowri and** nephew Udath.

I place my deep sense of gratitude with at most sincerity and profound indebtedness to my guide and chairman of my Advisory Committee, **Dr. K. B. Umesh,** Professor & University head, Dept. of Agril. Economics, UAS, Bengaluru for his valuable guidance, untiring patience, cooperation and moral support throughout my study period. I feel really proud for the privilege of being his student and for all he has done as a major advisor.

With immense pleasure and deep respect, I express heartfelt gratitude to all the members of Advisory Committee, **Dr. Srikanthamurthy**, Associate Professor, Dept. of Agril. Economics, GKVK, **Dr. Rajendra Prasad**, Dean (Agri), GKVK and **Dr. T. L. Mohan kumar**, Assistant Professor, Dept of Agril Statistics, Applied Mathematics and Computer Science for their excellent guidance, encouragement, valuable suggestions and critical evaluation of the manuscript.

I indebted to all my teachers, **Dr, B.V. Chinnappa Reddy**, **Dr. G. S. Mahadevaiah, Dr. Gaddi, Sri, Honnaiah, Dr. H. Lokesha, Sri. Mallikarjuna Swamy, Dr. Mamatha Girish, Mr. Jagannath Olekar and Dr. Anjan Kumar** for being the lighthouses in this hard journey.

I express my sincere thanks to Vishwanath, marketing head, Karnataka State Seed Corporation limited for his guidance and support.

I wish to convey my thanks to all sample farmers of **Mysuru** and **Chikkaballapura** districts for their cooperation during the time of field data collection and for having spared their valuable time without which this study would not have been possible.

I wish to convey my thanks to my classmates **Murali (Kadpapa), Pooja** (Teddy), **Sanjana** (Maneyaali), **Ashoka** (Bro), **Srinatha** (Seminarmate), **Mahesh**, **Siddaraju Kiran**, **Santhosh** (DM), **Shoba**, **Pavitra** (kadandhi), **Anupama** and **Sagar** (Sagya).

I also have been highly fortunate in having many friends whose hands were evident at every moment of tension, anxiety and achievements. I am ever greatful to **Swathi, Prasad, Prajwal, Shobha, Standly, Tejesh** and others. I thank them for being close to me and making my life a memory to be cherished.

I was privileged to have a great group of beloved senior friends in our department who were always there to offer unconditional help when needed. I thank **Ravi** (Subbi), **Uday, Satishkumar, Gururaj**, **Kadli**, **Ammu**, **Ashwini**, **Suhas, Shalini, Sangeetha, Hams, Bhavya, Merlin, Roopa, Sadhana, Veerbhadrappa, Ramesh, Pavithra** and others for their valuable guidance and support during my college days. Also I have lovely junior friends in the department who were always ready to offer help when needed. I thank **Gooli, Banda, Teju, Paatila, Bilaal, Dev, Kokare, Radha, Sindhu, Harika, Apeksha, Vinutha, Sowjanya** and **Pavitra**.

I wish to express thanks to all the supporting staff of the Economics department **Smt. Sujatha Devi, Sri. Narasimha Murthy** and **Sri. Devraj** for their support and help during my course of work.

Any omission in this brief acknowledgement does not mean lack of gratitude.

Bengaluru

August, 2018 **(THEJASHREE, H. N.)**

ECONOMICS OF SEED PRODUCTION OF SELECTED FOOD GRAINS IN KARNATAKA

THEJASHREE, H. N

ABSTRACT

The study examines the economics of seed production to compute the cost and returns and resource use efficiency across varieties in different crops of seed production. The present study was based on primary data collected from Mysuru and Chikkaballapura districts in Karnataka of the agricultural year 2016-2017. Sample of 30 farmers in each variety *viz.*, IR-64 and Jyothi varieties of rice, BRG-1 and BRG-2 varieties of redgram and KBSH-44 and KBSH-53 hybrids of sunflower were selected. The per hectare cost of cultivation (Rs. 87,900), gross returns (Rs. 1,65,507) and net returns (Rs. 77,607) in Jyothi variety was higher than IR-64 variety in which the cost of cultivation, gross returns and net returns were Rs. 85,509, Rs.1,53,631 and Rs. 67,809, respectively. Since Jyothi variety fetches high market rate, the study reveals that seed production of Jyothi variety is profitable. The per hectare cost of cultivation (Rs. 58,989), gross return (Rs. 92,935) and net return (Rs. 33,946) with yield of 15.4 quintals in BRG-1 variety was higher than BRG-2 variety. Hence, production of BRG-1 variety has resulted in a win-win situation with higher yield and increased returns. In case of sunflower, KBSH-44 found to be superior than KBSH-53 realising gross returns of Rs. 1,90,890 and net returns of Rs. 87,941 with the yield 15.7 quintals, where as in case of KBSH-53 the gross returns and net returns were Rs. 1,78,460 and 75,131, respectively. The major benefits and constraints faced by seed producing farmers were assured market and non-availability of labour.

August, 2018.

Dept Agricultural Economics — **K. B. Umesh**

UAS, GKVK, Bengaluru — Major advisor

ಕರ್ನಾಟಕದಲ್ಲಿ ಆಯ್ದ ಆಹಾರ ಧಾನ್ಯಗಳ ಬೀಜ ಉತ್ಪಾದನೆಯ ಆರ್ಥಿಕತೆ

ತೇಜಶ್ರೀ, ಹೆಚ್. ಎನ್.

ಸಾರಾಂಶ

ಈ ಅಧ್ಯಯನವು ವಿವಿಧ ಆಹಾರ ಧಾನ್ಯಗಳ ಬೀಜ ಉತ್ಪಾದನೆಯಲ್ಲಾಗುವ ವೆಚ್ಚ ಹಾಗೂ ಆದಾಯ ಮತ್ತು ಸಂಪನ್ಮೂಲ ಬಳಕೆಯ ಸಾಮರ್ಥ್ಯವನ್ನು ಲೆಕ್ಕಾಚಾರ ಮಾಡುತ್ತದೆ. ಪ್ರಸ್ತುತ ಅಧ್ಯಯನವು ಕರ್ನಾಟಕದ ಮೈಸೂರು ಮತ್ತು ಚಿಕ್ಕಬಳ್ಳಾಪುರ ಜಿಲ್ಲೆಗಳಿಂದ ಸಂಗ್ರಹಿಸಲಾದ ೨೦೧೬-೧೭ರ ಕೃಷಿ ವರ್ಷದ ಪ್ರಾಥಮಿಕ ಮಾಹಿತಿಯನ್ನು ಆಧರಿಸಿದ್ದು, ಮಾಹಿತಿಯನ್ನು ವೈಯಕ್ತಿಕ ಸಂದರ್ಶನದ ಮೂಲಕ ಪೂರ್ವ ರಚಿಸಲಾದ ವೇಳಾಪಟ್ಟಿಯಿಂದ ಸಂಗ್ರಹಿಸಲಾಗಿದೆ. ಪ್ರತಿ ಪ್ರಭೇದಗಳಲ್ಲಿ ತಲಾ ೩೦ ರೈತರ ಮಾಹಿತಿಯನ್ನು, ಭತ್ತದ ಐಆರ್-೬೪ ಮತ್ತು ಜ್ಯೋತಿ ಪ್ರಭೇದಗಳನ್ನು, ಕಡಲೆಯ ಬಿಆರ್‌ಜಿ-೧ ಮತ್ತು ಬಿಆರ್‌ಜಿ-೨ ಪ್ರಭೇದಗಳನ್ನು ಮತ್ತು ಸೂರ್ಯಕಾಂತಿಯ ಕೆಬಿಎಸ್‌ಹೆಚ್-೪೪ ಮತ್ತು ಕೆಬಿಎಸ್‌ಹೆಚ್-೫೩ ಸಂಕರಣ ತಳಿಗಳನ್ನು ಪ್ರಸ್ತುತ ಅಧ್ಯಯನಕ್ಕಾಗಿ ಆಯ್ಕೆ ಮಾಡಲಾಗಿದೆ. ಜ್ಯೋತಿ ಪ್ರಭೇದದ ಬೀಜೋತ್ಪಾದನೆಯಲ್ಲಿ ಪ್ರತಿ ಹೆಕ್ಟೇರ್‌ಗೆ ವೆಚ್ಚ (ರೂ. ೮೭,೯೦೦), ಒಟ್ಟು ಆದಾಯ (ರೂ. ೧,೬೫,೫೦೭) ಮತ್ತು ನಿವ್ವಳ ಆದಾಯವು (ರೂ. ೭೭,೬೦೭) ಐಆರ್-೬೪ ಪ್ರಭೇದಕ್ಕಿಂತಲೂ ಹೆಚ್ಚಾಗಿದ್ದು, ಐಆರ್-೬೪ ಪ್ರಭೇದದ ಬೀಜೋತ್ಪಾದನೆಯಲ್ಲಿ ಪ್ರತಿ ಹೆಕ್ಟೇರ್‌ಗೆ ವೆಚ್ಚ (ರೂ. ೮೫,೫೪೯), ಒಟ್ಟು ಆದಾಯ (ರೂ. ೧,೫೩,೬೩೧) ಮತ್ತು ನಿವ್ವಳ ಆದಾಯ (ರೂ. ೬೭,೮೪೯) ವನ್ನು ದಾಖಲಿಸಲಾಗಿರುತ್ತದೆ. ಮಾರುಕಟ್ಟೆಯಲ್ಲಿ ಜ್ಯೋತಿ ಪ್ರಭೇದಕ್ಕೆ ಹೆಚ್ಚಿನ ದರವಿರುವುದರಿಂದ, ಜ್ಯೋತಿ ಪ್ರಭೇದದ ಬೀಜೋತ್ಪಾದನೆಯು ಲಾಭದಾಯಕವೆಂದು ಈ ಅಧ್ಯಯನವು ತಿಳಿಸುತ್ತದೆ. ಬಿಜಿಆರ್-೧ ಪ್ರಭೇದದಲ್ಲಿ ೧೫.೪ ಕ್ವಿಂಟಾಲ್ಗಳ ಇಳುವರಿಯನ್ನು ದಾಖಲಿಸಲಾಗಿದ್ದು, ಪ್ರತಿ ಹೆಕ್ಟೇರ್‌ಗೆ ಲಭಿಸುವ ವೆಚ್ಚ (ರೂ. ೫೮,೯೮೯), ಒಟ್ಟು ಆದಾಯ (ರೂ. ೯೨,೯೩೫) ಮತ್ತು ನಿವ್ವಳ ಆದಾಯವು (ರೂ. ೩೩,೯೪೬) ಬಿಆರ್‌ಜಿ-೨ ಪ್ರಭೇದದ ಬೀಜೋತ್ಪಾದನೆಗಿಂತ ಹೆಚ್ಚಾಗಿದೆ. ಬಿಜಿಆರ್-೧ ಪ್ರಭೇದದ ಬೀಜೋತ್ಪಾದನೆಯು ಹೆಚ್ಚಿನ ಇಳುವರಿ ಮತ್ತು ಹೆಚ್ಚಿನ ಆದಾಯಗಳಿಂದ ಕೂಡಿದ್ದು, ಲಾಭದಾಯಕವಾಗಿರುತ್ತದೆ. ಅದೇ ರೀತಿಯಲ್ಲಿ ಸೂರ್ಯಕಾಂತಿಯ ಪ್ರಭೇದಗಳಲ್ಲಿ ಕೆಬಿಎಸ್‌ಹೆಚ್-೪೪ ಸಂಕರಣ ತಳಿಗಳಲ್ಲಿ ಬೀಜೋತ್ಪಾದನೆಯು ಕೆಬಿಎಸ್‌ಹೆಚ್-೫೩ ಸಂಕರಣ ತಳಿಗಳ ಬೀಜೋತ್ಪಾದನೆಗಿಂತಲೂ ಲಾಭದಾಯಕವಾಗಿರುತ್ತದೆ ಎಂದು ಕಂಡುಬಂದಿದೆ. ಕೆಬಿಎಸ್‌ಹೆಚ್-೪೪ ಸಂಕರಣ ತಳಿಗಳಲ್ಲಿ ೧೫.೭ ಕ್ವಿಂಟಾಲ್ಗಳ ಇಳುವರಿಯನ್ನು ದಾಖಲಿಸಲಾಗಿದ್ದು, ಪ್ರತಿ ಹೆಕ್ಟೇರ್‌ಗೆ ದೊರೆಯುವ ಒಟ್ಟು ಆದಾಯ (ರೂ. ೧,೯೦,೮೯೦) ಮತ್ತು ನಿವ್ವಳ ಆದಾಯವು (ರೂ. ೮೭,೯೪೧) ಕೆಬಿಎಸ್‌ಹೆಚ್-೫೩ ಸಂಕರಣ ತಳಿಗಳ ಬೀಜೋತ್ಪಾದನೆಗಿಂತ ಹೆಚ್ಚಾಗಿದೆ. ಬೀಜೋತ್ಪಾದನೆಯಲ್ಲಿ ರೈತರಿಗೆ ದೊರೆಯುವ ಪ್ರಯೋಜನವೆಂದರೆ ನಿಶ್ಚಿತ ಮಾರುಕಟ್ಟೆ ಮತ್ತು ನಿಶ್ಚಿತ ಮಾರುಕಟ್ಟೆಯ ದರ ಹಾಗೂ ಎದುರಿಸುವ ನಿರ್ಬಂಧವೆಂದರೆ ಕಾರ್ಮಿಕರ ಕೊರತೆ ಎಂದು ಈ ಅಧ್ಯಯನದಿಂದ ತಿಳಿದು ಬರುತ್ತದೆ.

ಆಗಸ್ಟ್, ೨೦೧೮

ಕೃಷಿ ಅರ್ಥಶಾಸ್ತ್ರ ವಿಭಾಗ
ಕೃವಿವಿ, ಗಾಕೃವಿಕೆ, ಬೆಂಗಳೂರು

ಕೆ. ಬಿ. ಉಮೇಶ್
ಪ್ರಧಾನ ಸಲಹೆಗಾರರು

ECONOMICS AND EFFICIENCIES IN CERTIFIED rice SEED PRODUCTION

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Introduction

- Seed is a vital input and dynamic instrument for increasing agricultural production. It has been reported that good quality seed alone can increase crop production by 18-20 percent.
- Quality seed production is a specialized activity that paves way for initial assurance towards realization of higher output.
- A sustained increase in agricultural production and productivity depends on development of new improved varieties and adequate supply of quality seed to farmers at the right time at reasonable price.

Against this back drop present study was taken.

Objectives

1. To estimate the cost and returns of certified seed production.
2. To assess resource use efficiency in seed production.

Hypotheses:

- There is no difference in cost of seed production across varieties.
- Resources are efficiently utilized in seed production.

Methodology

Study area and sampling:

Mysuru was taken as the study area as it is one among the districts producing highest paddy seed in Karnataka. Random sampling procedure was adopted in selection of farmers who grow rice (Jyothi and IR-64 varieties) certified seeds under Karnataka State Seed Corporation Limited.

Source of data:

The data pertaining to agricultural production year 2016-17 (Kharif) was collected from the sample farmers using well-structured pretested schedule by personal interview.

Analytical tools and techniques employed

- Cost and returns
- Cobb-Douglas type of production function. Following is the per farm production function specified for the purpose.

$$Y = a X_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} X_7^{b7} e^u$$

Y = Gross returns (₹)
X_1 = Seed cost (₹)
X_2 = FYM cost (₹)
X_3 = Fertilizer cost (₹)
X_4 = Plant protection chemical cost (₹)
X_5 = Human labour cost (₹)
X_6 = Machine labour cost (₹)
X_7 = Area in acre
a = Intercept and u = random variable.
b_1 to b_7 = elasticity co-efficients .

- DEA method.

Results

Table 1: Per hectare cost and returns of certified seed production (₹)

Particulars	IR-64	Jyothi
Total variable cost	64,871	67,175
Total fixed cost	20,638	20,725
Total cost of cultivation**	85,509**	87,900**
Main product (q)	59.68	54.78
Rejected Product (q)	9.16	7.66
By-product (straw)	7,221	11,376
Gross returns	1,53,637	1,65,507
Net returns	67,809	77,607
Cost of production (/q)	1,242	1,408
Returns per rupee of expenditure	**1.80**	**1.88**

Note: ** Significance at one percent.

Table 2: Estimates of the Cobb-Douglas type of production function (per farm)

Variables	Para -meters	IR-64	Jyothi
Intercept	a	12434.34* (5.69)	377.37* (5.06)
Seeds cost (X_1)	b_1	-0.003 (-1.99)	0.012 (1.94)
FYM cost (X_2)	b_2	0.0005 (0.02)	0.045 (1.48)
Fertilizer cost (X_3)	b_3	0.021** (6.07)	0.007 (0.16)
Plant protection chemical cost (X_4)	b_4	0.023 (0.98)	0.02* (2.05)
Human labour cost (X_5)	b_5	0.025* (2.25)	0.115 (1.60)
Machine Labour cost (X_6)	b_6	0.014 (0.31)	0.014 (0.41)
Area in acre (X_7)	b_7	0.885** (4.52)	0.50** (4.68)
Co-efficient of multiple determination	R^2	0.79	0.95
F value		1.41**	8.4**

Note: 1. **- Significance at 1 % and *- Significance at 5 %
2. Figures in parentheses represents 't' value.

Discussion

- Variable cost accounts for 75 percent of the total cost in both the varieties. Labour cost forms the major portion 30 % in IR-64 and machine labour forms 25% in Jyothi variety. Results are in conformity with Nirmala (2007) (Table 1) .
- There was significant difference in cost of production between varieties (Table 1). Hence the hypothesis that there is no difference in cost of seed production across varieties is rejected.
- The production function estimates indicated that fertilizers, human labour and area under rice seed production in IR-64 and plant protection chemicals and area under rice seed production in Jyothi have significant influence on gross returns (Table 2).
- The analysis of resource use efficiency showed that there is no scope for increase in input use particularly in case of fertilizers, PPC, human labour and area, therefore hypothesis that resources are efficiently utilised in seed production is rejected (Table 3).
- The findings also demonstrated that seed production is more profitable compared to grain production (Fig 1).
- Majority of farmers showed higher (more than 0.7) efficiency (Table 4).

Table 3: Resource use efficiency in certified rice seed production (per farm)

Varieties	IR-64		Jyothi	
Variables	Co-efficient	MVP/ MFC	Co-efficient	MVP/ MFC
Seeds	-0.003	-0.18	0.012	0.97
FYM	0.0005	0.01	0.045	2.75
Fertilizer	0.021*	0.71	0.007	0.29
PPC	0.023	5.19	0.020**	0.96
Human Labour	0.025**	0.24	0.115	1.61
Machine Labour	0.014	0.16	0.014	0.21
Area in acres	0.885*	1.65	0.506*	1.10

Fig 1: Relative Economics of seed and grain production.

Note: Data pertaining to rice grain cultivation was taken by a study conducted by Satishkumar, M., (2017).

Table 4: Technical, Allocative and Cost Efficiency of certified rice seed production

variety	IR-64			Jyothi		
Efficiency	TE	AE	CE	TE	AE	CE
0.5-0.6	0	0	2	0	0	0
0.6-0.7	0	4	3	2	0	4
0.7-0.8	1	11	10	4	3	6
0.8-0.9	1	5	7	5	3	11
0.9-1	28	10	8	19	24	9
Total	30	30	30	30	30	30
Average	**0.90**	**0.91**	**0.83**	**0.92**	**0.92**	**0.845**

Note: TE: Technical efficiency, AE: Allocative efficiency, CE: Cost efficiency

Summary

- Seed production was found profitable. Jyothi variety was superior to IR-64 in terms of Net returns.
- Resources were not utilized efficiently, there is a need to educate farmers on optimum use of resources.

Reference :

NIRMALA SANDIGODMATH, M., 2007, Sunflower seed production under contract farming in Haveri district, Karnataka – An economic analysis. *M.Sc Thesis (Unpub.)*, Univ. Agric. Sci., Dharwad.

SATISHKUMAR, M., 2017, Farm Mechanization vis-a-vis agricultural labour scarcity: impact on income of farm households in Karnataka. *Ph.d Thesis (Unpub.)*, Univ. Agric. Sci., Bengaluru.

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CONTENTS

Chapter No.	Title	Page No.
I	INTRODUCTION	1
II	REVIEW OF LITERATURE	8
III	METHODOLOGY	21
IV	RESULTS AND DISCUSSION	33
V	SUMMARY AND CONCLUSION	81
VI	REFERENCES	87
	APPENDIX	92

LIST OF TABLES

Table No.	Title of Tables	Page No.
4.1	Socio-economic characteristics of farmers taking up rice seed production in Mysuru district.	34
4.2	Socio-economic characteristics of farmers taking up red gram seed production in Chikkaballapura district	36
4.3	Socio-economic characteristics of farmers taking up sunflower seed production in Chikkaballapura district.	38
4.4	Possession of major farm machinery/ equipment's / assets of rice seed producing farmers in the study area	39
4.5	Possession of major farm machinery/ equipment's / assets of red gram seed producing farmers in the study area	40
4.6	Possession of major farm machinery/ equipment's/ assets of sunflower seed producing farmers in the study area	41
4.7	Cost of cultivation of certified seed production of IR-64 variety of rice (ha^{-1})	44
4.8	Returns from certified seed production of IR-64 variety of rice (ha^{-1})	44
4.9	Cost of cultivation of certified seed production of Jyothi variety of rice (ha^{-1})	45
4.10	Returns from certified seed production of Jyothi variety of rice (ha^{-1})	45
4.11	Cost of cultivation of certified seed production of BRG-1 variety of red gram (ha^{-1})	48
4.12	Returns from certified seed production of BRG-1 variety of red gram (ha^{-1})	48
4.13	Cost of cultivation of certified seed production of BRG-2 variety of red gram (ha^{-1})	49
4.14	Returns from certified seed production of BRG-2 variety of red gram (ha^{-1})	49
4.15	Cost of cultivation of certified seed production of KBSH-44 variety of sunflower (ha^{-1})	51

Table No.	Title of Tables	Page No.
4.16	Returns from certified seed production of KBSH-44 variety of sunflower (ha^{-1})	52
4.17	Cost of cultivation of certified seed production of KBSH-53 variety of sunflower (ha^{-1})	52
4.18	Returns from certified seed production of KBSH-53 variety of sunflower (ha^{-1})	53
4.19	Comparison between seed production and conventional production on per hectare basis	54
4.20	Resource - use pattern in IR-64 and Jyothi varieties of rice seed production	56
4.21	Resource - use pattern in BRG-1 and BRG-2 varieties of red gram seed production	57
4.22	Resource - use pattern in KBSH-44 and KBSH-53 varieties of sunflower seed production	57
4.23	Labour utilization pattern in seed production	58
4.24	Estimates of Cobb-Douglas production function in IR-64 and Jyothi varieties of rice certified seed production	59
4.25	Estimates of Cobb-Douglas production function in BRG -1 and BRG -2 varieties of red gram certified seed production	61
4.26	Estimates of Cobb-Douglas production function in KBSH-44 and KBSH-53 varieties of sunflower certified seed production	62
4.27	Resource - use efficiency in IR-64 rice certified seed production.	64
4.28	Resource - use efficiency in Jyothi rice certified seed production	64
4.29	Resource - use efficiency in BRG-1 red gram certified seed production	65
4.30	Resource - use efficiency in BRG-2 red gram certified seed production	65
4.31	Resource - use efficiency in KBSH-44 sunflower certified seed production.	66
4.32	Resource - use efficiency in KBSH-53 sunflower certified seed production	66

Table No.	Title of Tables	Page No.
4.33	Technical, Allocative and Cost Efficiency of certified rice seed producing farms of IR-64 and Jyothi varieties	67
4.34	Technical, Allocative and Cost Efficiency of certified red gram seed producing farms of BRG-1 and BRG-2 varieties	68
4.35	Technical, Allocative and Cost Efficiency of certified sunflower seed producing farms of KBSH-44 and KBSH-53 varieties.	69
4.36	Crop-wise Requirement (Demand) and Availability (Supply) of Certified/Quality seed in India	71
4.37	Requirement and Availability of rice certified/quality Seed in Karnataka	72
4.38	Requirement and Availability of red gram certified/quality Seed in Karnataka	72
4.39	Requirement and Availability of sunflower certified/quality Seed in Karnataka	73
4.40	Requirement and Availability of IR-64 and Jyothi varieties of rice certified/quality Seed in Karnataka	73
4.41	Requirement and Availability of BRG-1 and BRG-2 varieties of red gram certified/quality Seed in Karnataka	74
4.42	Requirement and Availability of KBSH-44 and KBSH-53 varieties of sunflower certified/quality Seed in Karnataka	74
4.43	Opinion of respondents on the benefits in rice seed production	75
4.44	Opinion of respondents on the constraints in rice seed production	76
4.45	Opinion of respondents on the benefits in redgram seed production.	77
4.46	Opinion of respondents on the constraints in redgram seed production	78
4.47	Opinion of respondents on the benefits in sunflower seed production	80
4.48	Opinion of respondents on the constraints in sunflower seed production	80

LIST OF FIGURES

Figure No	Title of Figures	Between pages
3.1	Map showing the study area	22-23
4.1	Share of variable cost in IR-64 rice seed production	46-47
4.2	Share of variable cost in Jyothi rice seed production	46-47
4.3	Share of variable cost in BRG-1redgram seed production	50-51
4.4	Share of variable cost in BRG-2 redgram seed production	50-51
4.5	Share of variable cost in KBSH-44 sunflower seed production	54-55
4.6	Share of variable cost in KBSH-53 sunflower seed production	54-55
4.7	Relative economics of seed and grain production in rice	54-55
4.8	Relative economics of seed and grain production in redgram	54-55
4.9	Relative economics of seed and grain production in sunflower	54-55
4.10	Requirement availability and gap in certified seeds in India	72-73
4.11	Benefits ranked by respondents of IR-64 and Jyothi rice seed producers.	72-73
4.12	Benefits ranked by respondents of BRG-1 and BRG-2 redgram seed producers.	78-79
4.13	Benefits ranked by respondents of KBSH-44 and KBSH-53 sunflower seed producers	78-79

LIST OF PLATES

Figure No	Title of Figures	Between pages
1	Primary data collecting from the seed growing farmer Nagaraj in Nagarle	80-81
2	Primary data collecting from the seed growing farmer Ranga reddy in Purigali	80-81

I INTRODUCTION

Importance of seed

Increasing agricultural production is always the talk of the day which is one of the means for the economic development of the country. A significant increase in agricultural production largely depends upon the quality of input resources used. Seed material is the basic and vital input in agriculture production programme and quality of seed is the major determinant of output growth, given other complementary inputs such as fertilizers, irrigation, fungicides and pesticides.

The response of all other inputs depends on quality of seeds to a larger extent. It is estimated that the direct contribution of quality seed alone to the total production is about 15 – 20 per cent depending upon the crop and it can be further raised up to 45 per cent with efficient management of other inputs. (www.seednet.gov.in). Seed cost forms very small part of the total cultivation expenses in field crops, but without the quality seeds the expenditure on other inputs like fertilizers, pesticides will not yield the adequate returns.

In the traditional agriculture, seed was not a purchased input and most of the farmers were using farm saved grains as seed material. Seed production was then viewed as a commercial enterprise, due to the introduction of "High Yielding Varieties Programme" in 1966 (Agarwal, 1980), seed production has become one of the profitable enterprises in the country. The high yield potentials of hybrid seeds, so also of the high yielding varieties and comparatively higher monetary returns from seed production have led farmers to go in for the seed production activity (Sekhon, 1986).

In fact, seed is the real vehicle of production while the other inputs like water and fertilizers can be regarded as fuel. Thus, quality seed production plays an important role in the agricultural production and productivity. Thus, for increasing the productivity levels in crops, “Quality seed is a must”. It is necessary to provide quality seed on time, in adequate quantities near the door steps of the farmers.

Indian seed scenario

The development of seed industry in India, particularly in the last 30 years, is significant. A major re-structuring of the seed industry by Government of India through the National Seed Project Phase-I (1977-78), Phase-II (1978-79) and Phase-III (1990-1991), was carried out, which strengthened the seed infrastructure that was most needed. This could be stated as a turning point in shaping of an organized seed industry. Introduction of New Seed Development Policy (1988 – 1989) was yet another significant step in the Indian Seed Industry, which transformed the industry. The policy stimulated investments by private individuals, Indian Corporate and MNCs in the Indian seed sector with strong R&D base for product development in each of the seed companies with more emphasis on high value hybrids of cereals and vegetables and hi-tech products such as Bt. Cotton. But there is a need for the State Seed Corporations to transform themselves in tune with the industry in terms of technologies, infrastructure and the management culture to be able to survive in the competitive market and to enhance their contribution in the national endeavour of increasing food production to attain food security.

The Indian seed programme largely adheres to the limited generation system for seed multiplication. The system recognizes three generations namely breeder, foundation and certified seeds and safeguards the quality of seeds in multiplication.

In India, the public seed sector consists of national-level corporations, i.e., the National Seeds Corporation (NSC) and state-level organizations, viz., State Seed Corporations (SSCs). The Central Seed Committee (CSC) and Central Seed Certification Board (CSCB) are apex agencies set up under the Seed Act (1966) to ensure the production of certified and quality seeds in the country. Under the Seeds Act, State Seed Certification Agencies (SSCA), State Seed Testing Laboratories (STL), Central Seed Testing Laboratories (CSTL), Seed Law Enforcement Authorities (at the state level) and National Seed Research and Training Centre (NSRTC) were set up to deal with all the matters relating to the regulation of quality seeds.

Karnataka State Seeds Corporation Limited (KSSC)

Karnataka State Seeds Corporation Limited is a Government agency registered under Companies Act, 1956 for dealing with production and supply of foundation and certified seeds to farmers of the State. They screen the application forms of seed growers for certified seed production programmes, carry out field inspections and conduct Grow-out test before the procurement of seeds from the farmers to ensure the genetic and physical purity of seeds. In 2016 kharif season, KSSC has produced 1,24,197 q of cereals, 11,080 q of pulses and 18,568 q of oilseeds certified seeds. Among cereals rice contribute major part by 1,09,215 q of certified seeds, among pulses 6,797 q of Redgram certified seeds were produced and 500 q of sunflower certified seeds were produced.

Rice

Rice (*Oryza sativa* L.) is the most important staple grain in India. Therefore, food security is essentially a reflection of rice security in this region. India has the largest rice output in the world and occupies the place of fourth largest exporter of rice in the world. In India, rice cultivation plays a major role in socio-cultural life of rural India. Many festivals such as Onam in Kerala, Bihu in Assam, Makara Sankranthi in Andhra Pradesh and Karnataka, Thai Pongal in Tamil Nadu, Nabanna in West Bengal celebrates harvest of rice. In the country, rice is grown in 43.86 million ha, the production level is 104.80 million tones and the productivity are about 2390 kg/ha. Cultivation of rice in Karnataka state is as old as its cultivation in the country. It is one of the major rice-producing states of India and rice is grown in a variety of soils, wide range of rainfall, temperature and varied agro-ecological situations. In the state, two crops of rice are taken in a year, black gram / green gram is cultivated after rice crop. The first crop is cultivated from June-July and harvested during December and the second crop is sown during January and harvested in the months of April-May. In canal irrigated areas of the state the cropping patterns like Rice-Rice-fallow, Rice-Ragi or Rice-Pulses are being followed.

Nutritionally, 100 g of cooked rice contains 69 per cent of water, 2.4 g of protein, 28.7 g of carbohydrates, 0.2g of fat, 0.01g of Omega-3 and 0.04g of Omega-6, even small quantity of vitamins like Manganese, Selenium, Thiamine, Niacin, Magnesium and Copper.

Redgram

Redgram (*Cajanus cajan* L.) is one of the protein rich pulse crops in India which is also called as Pigeon pea or Arhar or Tur. India is the largest producer and consumer of Redgram, accounting for 63 per cent of total production and 72 per cent of area grown at the global level by having 3.9 million hectares of land under Redgram cultivation, with a production and productivity of 3.07 MT and 806 kg/ha, respectively. It is an important crop of Karnataka, contributing around 18 per cent and 12 per cent to total area and production, respectively and around seven per cent of area under total certified seed production.

Redgram is used as both the food crop (dried peas, flour, or green vegetable peas) and forage/cover crop. In combination with cereals, pigeon peas make a well-balanced meal and hence are favoured by nutritionists as an essential ingredient for balanced diets. The dried peas may be sprouted briefly, then cooked, for a flavour different from the green or dried peas. Sprouting also enhances the digestibility of dried pigeon peas via the reduction of indigestible sugars that would otherwise remain in the cooked dried peas.

Nutritionally, 100 g of mature Redgram contains 1,435 KJ of energy, 62.78 g of carbohydrates, 1.49 g of fat and 21.7 g of protein like Tryptophan, Threonine, Isoleucine, Lysine, Lucien, Methionine, Cysteine, vitamins like Thiamine, Riboflavin, Niacin, vitamin C, E, K minerals like Calcium, Iron, Magnesium, Manganese, Phosphorus, Sodium and Zinc.

Sunflower

Sunflower (*Helianthus annuus* L.) is an important oilseed crop in India popularly known as "Surajmukhi." The name "*Helianthus*" is derived from '*Helios*' meaning 'sun' and '*anthos*' meaning 'flower'. It is one of the fastest growing annual oilseed crops in India. India is one of the largest producers of oilseed crop in the World. Oilseeds occupy an important position in the Indian agricultural economy. Due to source of high quality edible oil, sunflower oil is used as cooking oil in different recipes. Its importance increases as sunflower oil is considered as heart friendly oil.

Besides oil, almost every part of sunflower has commercial value. It is used in the manufacturing of paints, resins, plastics, soap, cosmetics and many other industrial products. The sunflower crop has gained importance due to its short duration of maturity, excellent quality of oil, photo-insensitivity, and wide adaptability into different kinds of cropping pattern, high-energy hull and drought tolerance. It is a short duration crop and can be incorporated in different types of cropping patterns. Sunflower is grown as inter cropping with crops such as groundnut, pigeon pea, castor, soya bean and black gram. Since it is a photo insensitive crop, it can be grown throughout the year. Oil cake is rich in high quality protein (40-44 %) and used as cattle and poultry feed. This crop is considered valuable from economic as well as ornamental point of view.

Nutritionally, 100 grams of sunflower seeds contain 611 calories, 17.2 g of carbohydrates, 56.3 g of fat and 21.7 g of protein, vitamins and minerals like Selenium and Copper.

Need for the present study

There are several studies on Economics of Crop Cultivation but very few on seed production. Hence, this study makes a fair attempt to quantify the Economics of Seed production. The certified/quality seeds are not available to meet the farmers demand in Karnataka at right place and at right time with reasonable cost. To meet requirements the KSSC, NSP, UAS *etc.* agencies are involved in seed production. The seed production targets are being fulfilled by several ways including contract farming

The outcome of the study helps in the determination of scale of finance for seed production as credit is one of the limiting and crucial input. This study also aims at providing insights to the policy makers regarding the subsidy as well as encouraging the farmers in undertaking the quality seed production activities so that the gap in certified seeds can be met.

Specific Objectives

1. To estimate the cost and returns of certified seed production.
2. To assess resource use efficiency in seed production.
3. To assess the supply-demand gap in quality seed production.
4. To document the benefits and constraints in seed production.

Hypotheses

- In seed production, labour cost forms more than 25 per cent of cost cultivation.
- There is no difference in cost of seed production across varieties.
- Return per rupee of expenditure does not differ in cost of seed production across varieties.
- Resources are efficiently utilized in seed production.
- In case of rice and redgram certified seeds demand supply gap is more than 10 per cent.
- In case of sunflower, certified seeds demand supply gap is more than 30 per cent.

Limitation of the study

Though the study tries to be comprehensive in its scope, there are a few limitations inherent to it. Due to the limitation of time and other resources, the study was conducted only in two districts. Further, the expressed opinion of the respondents with regard to various issues of the study may not be totally free from personal bias and prejudice. Hence, the results of the study cannot be generalized beyond the limits of the study area.

Presentation of the study

The entire study has been presented in six chapters,

- Introduction: The nature and importance of research problem, specific objectives and hypotheses of the study have been presented in this chapter.

- Review of Literature: It deals with the review of the relevant concepts and past studies useful for the present study.
- Methodology: This chapter highlights overview of the study area, the nature and sources from where relevant data have been collected, the analytical tools employed for evaluating objectives of the study.
- Results and Discussion: The results of the study and their analysis have been presented in this chapter in the form of tables, figures and graphs. Discussion emphasizes on interpretation of the results and attempts to establish relationships between certain variables and their outcomes.
- Summary and conclusion: Brief summary of the major findings of the study along with policy recommendations drawn from the findings have been presented.
- References: The list of literatures referred is presented in this chapter.

II REVIEW OF LITERATURE

With a view to evaluate the objectives of the study, it was considered desirable to have an idea of the findings of some of the earlier research studies and the methods adopted therein. Such a review of literature connected with the objectives of the study, would provide a basis either for confirming the earlier findings or for contradicting them and thereby suggest points of departure for further studies.

2.1 Cost and returns of certified seed production

Madalia and Patel (1984) compared the economic performance of seed production across two important varieties of hybrid cotton *viz.,* Hybrid-4 and Varalaxmi grown in Gujarat. The study found that during 1978-79, the per acre total cost of seed production of H-4 and Varalaxmi cotton came to be ₹ 23,234 and ₹ 23,101, respectively. Whereas, it was ₹ 24,338 (H4) and ₹ 21,445 (Varalaxmi) during 1979-80. During 1978-79 the cost on hired labour in H-4 cotton seed production constituted about 46 per cent of the total cost and that for Varalaxmi it was 47.04 per cent. It was also reported that the ratios of gross return to the total cost of production to be 1:1.34 and 1:1.29 during the year 1978-79 for H-4 and Varalaxmi, respectively and corresponding figures for 1978-80 year were 1:1.27 and 1:1.30.

Naik *et al.* (1996) conducted the study on economic aspects of tomato seed production in Dharwad district. They reported that the total cost of production per acre of tomato seed production increased with an increase in the size of holding. The total returns from per acre of tomato seed production was ₹ 45,800 for medium farmers, whereas for small and large farmers received ₹ 44,150 and ₹ 43,485, respectively. Net profits were the highest in case of medium category (₹ 33,215) farmers, followed by small (₹ 32,465) and large (₹ 30,779) farmers. This was due to lower cost of production and higher productivity in smaller sized farms compared to the larger ones.

Narayanakutty *et al.* (1998) worked out the economics of vegetable seed production at Agricultural Research Station, Mannuthy of the Kerala Agricultural University during the period 1994-95 to 1996-97. The study reported wide variation among cost of cultivation from ₹ 3,09,218 in the case of okra to ₹ 86,416 per hectare in melon. In case of all the crops, labour charges accounted the major portion. The per kg cost of seed production was ₹ 252.42 and ₹ 392.79 for okra and melon, respectively. The study estimated the benefit cost ratio, which was 1.98 and 1.27 for okra and melon, respectively indicating that seed production of okra has more profitable than melon.

Kannababu and Rana (2003) examined the economics of sorghum hybrids CSH 15R, CSH 16, CSH 18 and CSH 19R seed production in an experimental station in India during the *rabi* season of 2000-01. The estimated variable cost and fixed cost of sorghum hybrid seed production per hectare were ₹ 29,280 and ₹ 7,020, which were 81 and 19 per cent, respectively, of the total cost of seed production per hectare (₹ 36,300). Human labour and material constituted about 57 per cent of the variable cost. The total value of the produce was estimated at ₹ 52,750, while the net income worked out at ₹ 16,450 per hectare for sorghum hybrid seed production.

The study conducted by Radha and Chowdry (2005) on economics of seed production and commercial production of cotton in Andhra Pradesh reported that all costs were higher in seed production over commercial production, total cost of production ₹ 81,853 and ₹ 29,107 in seed production and commercial production, respectively. The study also reported benefit cost ratio of 0.29:1 in seed production when compared to commercial production.

Sandigomath (2011) carried out a study on hybrid sunflower in Haveri, Ranebennur and Hanagal taluks of Haveri district of Karnataka. The cultivation of hybrid sunflower seed production was profitable with net returns of ₹ 34,894 over total cost of ₹ 22,969 per hectare. The R^2 value of 0.77 indicated that the variables included explained 77 per cent of variation in sunflower seed production. The MVP to MFC in sunflower seed production explained that the inputs like human labour, bullock labour, organic manure, seeds, and inorganic fertilizers like phosphorus and plant protection chemicals were underutilized.

Menasinahal (2011) made a comparative economic analysis of cost of cultivation of paddy and cotton in Mundgoad and Haliyal taluks of Uttara Kannada District where paddy crop has largely been replaced by cotton were selected purposively. Comparison showed that total cost incurred in cotton cultivation (₹ 34,452.67/ha) was high compared to paddy (₹ 31,616.24/ha) and the net returns from cotton cultivation was ₹ 5,122.73 per hectare which was higher as compared to paddy (₹ 40,530.76) even the BC ratio was also higher in case of cotton (2.48) compared to paddy (2.28).

Kashikar (2012) conducted study on hybrid paddy seed production in Kaymore plateau and Chhatisgarh plain of Madhya Pradesh. The study revealed that the fertilizers constituted about 35 per cent of the total material cost of hybrid rice seed production followed by A line parentage constituted larger part of seed input 19.57 per cent and R line parentage accounted for about 2.21 per cent of the total input material cost. The profitability estimated was ₹ 92,045.65 per hectare with input output ratio of 1:3.80.

Jamadar *et al.* (2013) compared the economic performance of transplanted pigeon pea in Dharwad. The seed yield in case of 28 days old transplanted pigeon pea was significantly high (23.62 q/ha) with gross returns and net returns as Rs 92,880 and Rs 76,116 respectively, where in case of seedlings transplanted at 120 cm inter row spacing produced 22.46 q/ha seed yield with gross returns and net returns as Rs 88,760 and Rs 72,007, respectively. The study reported that the treatment combination of 28 days old seedlings transplanted at 120 cm inter row spacing was significantly superior with respect to seed yield (24.33 q/ha), gross returns (₹ 97,320) and net returns (₹ 80,565.34).

Kanannavar *et al*. (2013) conducted study on economic analysis of sunflower production. The study revealed that the sunflower cost of production per hectare was Rs 41,451, major portion was taken over by labour cost (39.16 %) followed by rental value of the land (17.88 %) and fertilizer cost (10.41 %) in the total cost. The net returns over total cost and returns per rupee of expenditure calculated was found to be Rs 21,140 per ha and 1.67, respectively.

A study by Sannamani (2014) revealed that the total cost of tomato hybrid seed production per acre was ₹ 3, 87,708 in Haveri district of Karanataka. Among various costs, the major portion was cost of human labour ₹ 2,22,287, while the average total fixed cost incurred was ₹ 5,177.59. The study concluded that the tomato hybrid seed production was profitable with ₹ 8,97,554 per acre as gross returns, ₹ 5,15,023 as net returns over total cost of cultivation. The seed growers realised ₹ 2.31 for every rupee of expenditure in tomato seed production.

Sureshkumar *et al.* (2014) analysed the cost structure of wheat crop in south Gujarat. The study revealed that the total cost of cultivation was highest in case of large farms ₹ 45,784 followed by medium farms ₹ 45,720 and small farms ₹ 39,016. The study reported that the high cost on large farms were associated with intensive use of human labour, bullock labour, manure and fertilizers. The overall input output ratio was also highest in large farms (1:1.48) followed by medium and small farms (1:1.43 and 1:1.35, respectively)

Mulimani (2015) estimated the cost of production of hybrid vegetable seed production in Haveri district and observed that per acre cost in case of chilli (Rs 2,66,708) followed by tomato (Rs 2,53,008) bitter gourd (Rs 93,502), and ridge gourd (Rs 91,296). The net returns over total cost per kg was accounted to ₹ 526.26 in bitter gourd, ₹ 442.06 in ridge gourd, ₹ 4,738 in chilli. The study also reported the returns per rupee of expenditure which accounted 1.81, 1.7, and 2.12 in bitter gourd, ridge gourd and chilli, respectively.

Economic analysis of pigeon pea seed production in Gulbarga district of Karnataka by Pal *et al*. (2016) showed a ratio of 32: 68 towards fixed and variable costs, with a total cost of ₹ 39,436 and the gross and net returns were ₹ 73,300 and ₹ 33,864 per hectare, respectively in pigeon pea certified seed production. The study concluded that the certified seed production results a win-win situation for farmers by realising higher yield and returns.

Satishkumar (2017) carried out the comparative economic analysis of cost of cultivation of paddy in case of mechanized and partially mechanized farms in Mandya taluk. Comparison showed that the total cost of cultivation was higher in partially mechanised farms (₹ 76,239) compared to mechanised farms (₹ 75,583). The mechanized farms showed net returns and return per rupee of expenditure per hectare of ₹ 43,595 and

1.58, respectively, which were higher than the partially mechanised farms (Rs 39,854 and 1.52, respectively).

Akshatha (2017) worked out the economics of vegetable-redgram in Ramanagara district and grain-redgram in Gulbarga district. The results revealed that the cost of cultivation per hectare was high in vegetable production (Rs 32,134) than in grain redgram (Rs 20,344). The study also revealed that the yield was higher in vegetable-redgram (14 q/ac) compared with grain-redgram production (5.5 q/ac). The study concluded that the use of inputs, vegetable-redgram farmers used higher quantity of all inputs except machine labour (hours) than the grain-redgram farmers.

The above studies clearly revealed that, cost of cultivation and cost of production were higher in seed production over commercial production, and the variable costs formed the major portion of total cost. Of the total variable cost, share of labour cost was highest.

2.2 Resource Use Efficiency in seed production.

Chulaki (2001) carried out a study to estimate the resource use efficiency of different inputs in hybrid seed production using Cobb-Douglas production function. The study revealed that out of six selected variables, land, fertilizer, irrigation charges and human labour inputs were significant at one per cent level, while FYM was significant at five per cent level of probability in the pooled category of KSSC seed growers and Mahyco seed growers.

Efficiencies of inputs used in paddy cultivation in Peechi command area of Thrissur district of Kerala was studied by Suresh and Reddy (2006). The study revealed that, the elasticity coefficients for the inputs like farmyard manure, chemical fertilizers and human labour were found to be positive and statistically significant. The highest MVP to MFC ratio was found for land (3.04) followed by fertilizers (2.83) and plant protection chemicals (1.57). The ratio for seed and farmyard manure were found non-significant, which indicated that there was no scope of increasing the seed rate and use of farmyard manure.

Sandigodmath (2007) examined the resource use efficiency in sunflower seed production in Haveri district. The ratio of MVP to MFC for human labour, bullock labour, organic manure, seeds, and inorganic fertilizers like phosphorus and plant protection chemicals showed that the resources were underutilized. And concluded that there is a scope to increase the level of inputs to realise economic efficiency.

Akighir and Shabu (2011) analysed the resource use efficiency in paddy production in Kwande local Government Area of Benue State Nigeria. Cobb Douglas production function and technical efficiency techniques were used as analytical tools. The study revealed that the sum of the coefficient of Cobb Douglas production function was 1.3 which implied that paddy farmers in the area were producing in the first stage of production. The technical efficiency estimates revealed that all the Marginal Physical Productivities (MPPs) were higher than the Average Physical Product (APPs) which also suggested that, the farmers were producing in the first stage of production. The study concluded that paddy farmers in Kwande local government were technically inefficient in paddy production.

Menasinahal (2011) revealed that the resources, chemical fertilizers, FYM and bullock labour were underutilized as the ratio of MVP to MFC was positive and more than unity in rice in Uttar Kannada district. The study also reported that in case of cotton, FYM and seeds were underutilized, which indicated that there was further scope for maximising returns by increased use of these resources.

Reddy and Reddy (2013) examined the resource use efficiency in paddy cultivation with comparison to different farm size in Nellore district. The results showed that, the resources like seeds, human-labour, pesticides and plant protection chemicals were under-utilized as their ratio of Marginal Value Product to Marginal Factor Cost was greater than one. Whereas the ratio of Marginal Value Product to Marginal Factor Cost was less than one for bullock labour, expenditure on tractor, chemical fertilizers and manures, which indicated resources were over utilized.

Sannamani (2014) assessed the resource use efficiency in tomato hybrid seed production. The MVP to MFC ratio of FYM (15.8) and bullock and machine hour (3.19) revealed that the resources were under-utilized. The MVP to MFC ratios of seedlings, human labour (0.069), fertilizer (0.033), PPC (0.126) and stacking materials (0.005) were substantially lesser than unity implying excess utilization of resources.

Vasanthi *et al*. (2015) carried a study on farm level technical efficiency of paddy farmers of tank irrigated systems in Tamil Nadu by stochastic frontier approach. The study revealed that the return to scale was 1.008 which indicated that farms were operated at a greater efficiency. The study further estimated the ratio of MVP to MFC which indicated that fertilizer was under-utilized and stated there is further scope to increase the same.

Mulimani (2015) studied the resource use efficiency in bitter gourd, ridge gourd and chilli seed production. In case of bitter gourd, the output elasticities of the resources like FYM (1.53), bullock and tractor charges (0.22) were significant, where as in case of ridge gourd FYM (0.47), irrigation (2.52) were found to be significant, and in tomato seed production output elasticities seedlings (0.540) and FYM (0.305) and PPC (0.197) were significant. In all the cases, fertilizer was found to be non-significant.

From the above reviews, it can be inferred that the resources were not optimally utilized in seed production, which clearly demonstrate the inefficiency in the use of scare resources. Some resources were over utilized and some were under-utilized. Hence, there is a need for reallocation of resources to maximize the profit (yield) in seed production.

2.3 Supply-demand gap in quality seed production

Radhakrishna and Venkatareddy (2002) used the piece-wise linear expansion system (LES) model to make demand projections for India by 2020. The projections made assumes real expenditure growth of 5 per cent per annum between 2000 and 2020, increase in population to 1.343 billion in 2020, rate of urbanization and rural and urban disparity consistent with the historical trends and the inequality in the income distribution and relative prices same as in the year 1998. The demand is projected to grow at 2.2 per cent for cereals during 2000-2010 and 2.0 per cent during 2010-2020, 3-4 per cent for edible oils and pulses, and 4-5 per cent for milk and milk products, meat, fish, eggs, fruits, vegetables, sugar and guar.

Begum and D’Haese (2010) studied the supply demand situation for rice and wheat in Bangladesh. The study estimated that, the average growth in rice production was 2.9 per cent per year in 1971-72 to 2008-09, of which 93 per cent was contributed by yield growth. The overall growth rate of area under food grain was 0.3 per cent in 1971-72 to 2008-09. The overall food grain production growth rate was higher than population growth rate from 1971-72 to 2008-09. The own price and income elasticities of rice were -0.108 and 0.199, respectively. It was projected that up to 2021, the annual demand for food exceeded the supply of food which were -0.28 per cent for rice and -1.76 per cent for wheat. That implies the demands were greater than the supplies for both crops.

Anon (2011) reported that in the year of 2008-09 India could harvest 233.88 million tons of food grains very close to the demand projection of 235 million tons by 2010-11 with ever highest procurement of 56 million tons of food grains. Growth in productivity of the two major food securing crops of wheat and rice declined over 1980-1990 decennial. Rice and wheat contributed 59 and 41 per cent to the total procurement and subsequently PDS. Consumers’ preference and area under coarse cereals with highest growth rate also declined and was another caution to augment food supplies in future. The growth rate for area, production, productivity of different food grains presented from 1984-86 to 2009-10.

Ganeshkumar *et al.* (2012) have attempted to project the future supply and demand up to the year 2025 for rice and wheat. In this study, a quadratic almost ideal demand system (QUAIDS), which allows for expenditure shares to rise or fall with rising incomes, was used to model household demand. The model was estimated with data on consumption of 11 major agricultural commodities from the 61st Round of the National Sample Survey (NSS) for year 2004–05 (NSSO 2006). Estimates suggest that the demand elasticity with respect to total food expenditure was negative for rice, wheat, and pulses, indicating a fall in the consumption of these commodities on a per capita basis over a fairly long period of time as income levels rose in the country.

Lakew and Alemu (2012) studied the approaches and procedures of seed demand assessment in the formal seed sector of Ethiopia. The demand for seeds of different crop varieties were assessed by following bottom up approach starting from Kebele to national level, which was done usually one season before. The study revealed that, since 2006-07 the trend in both demand and supply of seed was increasing in both hybrid and non-hybrid seeds. The study also observed that there was a big increase on the supply sides in the 2010-2011 production season, because of "Crash seed Multiplication Program" implemented by the Government of Ethiopia since 2009.

Adhikari (2013) conducted a study to analyse the market, demand, supply, import and export of vegetable seeds in Nepal. The study reported that there was steady growth in all requirement, supply and gap for last eight years. It was observed that in 2012 and 2013 years remained stable in all cases and there seems no expansion in market of seeds. The study found that the domestic supply was majorly fulfilled by formal production and almost all are OPVs whereas, the gap was fulfilled mainly from import of both OPVs and F1 hybrid varieties. Out of 950 MT of imported varieties, the share of F1 hybrids was approx. 35 MT (3.7 %). However, the value of hybrid seeds was estimated as equal to rest of all OPVs i.e. NPR 350 Million.

Oyinbo *et al.* (2013) took study on rice demand and supply in Nigeria. The time series data on the aggregate rice demand and supply obtained from the database of United State Department for Agriculture (USDA) foreign agricultural service were utilized in this study. A growth rate model was employed to analyse the time series data and the result of the analysis showed that the instantaneous and compound growth rates (7.5 % and 7.8 %) of rice demand were higher than that of rice supply (6.5 % and 6.7 %) which indicated that the incidence of demand-supply gap for rice in Nigeria has been an existing trend over the years and the trend would continue if appropriate measures were not taken despite the country's huge potential for rice production to attain self-sufficiency.

Trilokanatha (2013) examined the supply, demand and price behaviour in redgram and bengal gram in Madhya Pradesh. For the study the required data was collected from secondary sources for supply and demand at the national level for red gram and bengal gram. The study revealed that the supply was more than the demand in case of bengal gram and also opined that the situation continues till the year 2019, but later the demand exceeds supply to the extent of 4.89 million tons by 2025 and by the end of 2030 the gap was to the extent of 11.86 million tonnes. In case of red gram, demand exceeded supply and it was also expected to continue till 2030. In the study it was also estimated that, the short fall supply which was 12.27 million tons in 2020 is expected to increase to 38.48 million tons by end of 2030.

Patil *et al.* (2016) took study on food security with reference to demand-supply gaps in Akola district. The investigation was grounded on the secondary data collected from different government publications from the period of 1990 to 2010. In the study production projection exponential growth function has been used, the results showed that the gap of cereals availability and requirement was widening and will remain widening in coming years from 2,45,212 tons in 2015 to 3,40,765 tons during 2025. These forecasts in the study were constructed on adjustment in productivity levels, variations in price, growth of population and earnings progress.

2.4 Benefits and constraints in seed production.

Chulaki (2001) listed the problems faced by the seed growers of hybrid cotton seeds in Northern Karnataka. In the study, problems faced by the farmers were classified into production and marketing problems. Among production problems, non-availability of skilled labour and non-availability of financial assistance were the major ones.

Arunkumar (2002) identified the major problems faced by the contract farmers in vegetables in Belguam district. Low contract price and irregular payments were the major problems followed by unawareness of potentiality of crops, poor technical assistance, manipulation of norms by firms and higher rejection rate. The study also opined that contract farmers try to put lower grade into higher grade and it was difficult to check and make sure of the grade as quantity of land handled by the farmers was more.

Kumar and Kumar (2008) revealed that lack of credit for crop production, shortage of irrigation water at peak times and erratic power supply were the major constraints in case of both contract farmers and non-contract famers. Whereas the contract farmers faced additional problems like delayed payment for crop produce and difficulty in meeting the quality requirements. The study also listed the constraints faced by contracting agencies, frequent price fluctuations in international markets and scarcity of transport vehicles during peak periods were the major.

Jagadeesh (2011) studied efficiency of contract farming models in medicinal plants. The study reported that the high rejection rate of product (80 %), lack of timely availability of loans (70 %), delayed payments by companies (60 %) followed by manipulation of terms and conditions by contract farming companies (30 %) as major constrains in ashwagandha seed growers in Haveri District, Karnataka. The other problems noted were non-availability of package of practice (25 %), lack of technical assistance (15 %) and high cost of planting material (15 %).

Pal *et al*. (2016) in their study an economics of pigeon pea seed production reported that the factors constraining adoption of pigeon pea seed production technology as perceived by grain producers were small holding size (76 %) followed by unavailability of labour (68 %). The other factors unavailability of quality seed and high cost of cultivation occupied the same percentage in the ranking as 64 per cent, followed by lack of knowledge (58 %) and marketing of product (44 %) were opined as the constraints to take up seed production.

Gundappagol (2014) identified constraints of vegetable production in Belgaum district, more than 94.04 per cent of respondents expressed high incidence of pest and diseases followed by 88.88 per cent of respondents expressed high cost of insecticides, weedicides, pesticides and high cost of improved variety seeds, fertilizers and farm yard manure (82.96 %) was the major production problem making vegetable cultivation more expensive were the limiting factors in vegetable production.

Mulimani (2015) reported except tomato seed growers all the bitter gourd, seed growers stated climatic factors as the major problem faced in seed production followed by Inadequate and delayed loans for purchase of inputs, high wage rate and low contract price. The tomato seed growers opined that Non-availability of skilled labour (86.6 %) as major limitation followed by High wage rate (83 %), Climatic factors (80 %), low contract price

(70 %) and high pest and Disease attack (66.6 %) as the constraints in taking up the seed production.

Hemanthkumar and Singh (2005) studied success and failure of contract farming in cauliflower seed production in Himachal Pradesh during 2002-2003. The problems faced were absence of written legal agreement, lack of prior price information, near monopoly of big firms, deductions made to account the moisture content and foreign material in the seed.

Sandigodmath (2007) listed the problems faced by the sunflower seed growers. The major problems faced was high wage rate (81.1 %) followed by high cost of fertilizers and pesticides (73.3 %), inability to take effective control measures against pests and diseases (46.7 %), inadequacy of irrigation water (42 %) and non-availability of trained labour (37.8 %). The minor problems were isolation trouble, seed plot rejection, irregular payment, high rejection rate, low contract price and poor technical assistance.

Sekhon (2012) identified the constraints in sunflower production across small, medium and large farm size holding farmers. The major constraint stated by all the three categories of farmers was low price of the product (79.17 %). The second most constraint opined by small farmers was exploitation by middlemen (72 %), cheaper imports opined by both medium farmers and large farmers. The other constraints commonly listed by farmers were drying procedure, poor product handling, lack of marketing information, lack of transparency in marketing, high marketing cost, lack of processing facilities and poor packaging.

Sannamani (2014) reported the opinions of the seed growers on the problem of growing tomato hybrid seed crop right from the procurement of inputs in seed production process till the crop was marketed. In the ranking method, non-availability of skilled labour was given utmost priority by the farmers (78.83), the second importance was given to high wage rate (78.10), third and fourth ranks were high pest and disease attack (74.10) and lack of technical guidance (68.87). Non-availability of high yielding varieties, climatic factors and non-availability of seedlings on time occupied next three positions with score of 64.73, 54.80 and 35.65, respectively.

The above studies revealed that non-availability of labour, high wage rate, high incidence of pest was the major problem in seed production, where as in the contract-based seed production low contract price and high rejection rate were listed as constraints in seed production.

III METHODOLOGY

This chapter deals with brief description of the study area, methods and techniques used in selection of samples, nature and sources of data and various tools and techniques employed in analysing the data and evaluating the problems. The methodology adopted is discussed under the following sections:

3.1 Description of the study area

3.2 Sampling procedure adopted

3.3 Source and nature of data

3.4 Analytical tools and techniques employed

3.1 Description of the study area

The study was carried out in Mysuru district for rice seed production and Chikkaballapura district for red gram and sunflower seed production.

Mysore district

Mysuru district is located in Southern dry and Southern transition zones and it is in the southernmost part of Karnataka State. It experiences moderate climate with cool winters and warm summers with average rainfall of 804.2 mm. Physio-graphically, the area of the district can be classified as partly maidan and partly semimalnad (malnad hilly lands). It lies between 11°30' N to 12°50' N latitudes and 75°45' E to 77°45' E longitudes. It covers an area of 6763 km^2. It has seven taluks, H. D. Kote with an area 1618 square kilometre is the largest followed by Nanjangudu (982 km^2), Hunsur (897 km^2), Periyapatana (815 km^2), Mysuru (815 km^2), K.R. Nagara (605 km^2) and T. Narasipura (599 km^2).

The district covers a total geographical area of 6,763 square kilometre of which 62,851 hectares constitutes the forest land. The net cultivable land is 4,86,410 hectares and of these 1,14,010 hectares of land is irrigated. Mysore is the one among the districts growing highest rice certified seeds under Karnataka State Seed Corporation. The total area of rice seed production under Karnataka state seed corporation limited in 2016 was 2,443 acres.

Chikkaballapura district

Chikkaballapura district is located in the south eastern part of Karnataka and falls in the Eastern Dry Zone. It experiences a semi-arid climate characterized by typical monsoon tropical weather with hot summers and mild winters with an average rainfall of 785 mm. Geographical coordinates of the district latitude, longitude and altitude are 13º08'00.00" N, 78º08'01.69"E and 918 m, respectively.

It has six taluks, Chikkaballapura with an area 4,244 square kilometre is the largest followed by Bagepalli (929 km^2), Sidlaghatta (897 km^2), Gowribidanur (889 km^2), Gudibande (227 km^2) and Chintamani (15.21 km^2).

The district covers a total geographical area of 4,04,500 hectares of which 49,700 hectares constitutes the forest land. The net cultivable land is 1,70,700 hectares and of these 46,000 hectares of land is irrigated. Chikkaballapura is the one among the districts growing highest redgram and sunflower certified seeds under Karnataka State Seed Corporation. The total area of redgram and sunflower seed production under Karnataka State Seed Corporation limited in 2016 was 576 acres and 223 acres, respectively. The major source of irrigation is bore wells (96 %).

3.2 Sampling procedure adopted

Mysuru and Chikkaballapura districts of Karnataka were purposively selected, as they were among the highest seed growing districts under Karnataka State Seed Corporation. The list of farmers growing certified seeds were collected from Karnataka State Seed Corporation limited and random sampling technique was employed for the selection of sample farmers.

Two varieties of Paddy (Jyothi and IR-64) in T.Narsipura and Nanjangud taluks of Mysuru district, two varieties each of Red gram (BRG-1 and BRG-2) and Sunflower (KBSH-44 and KBSH-53) in Gowribidanur and Bagepalli taluks of Chikkaballapura

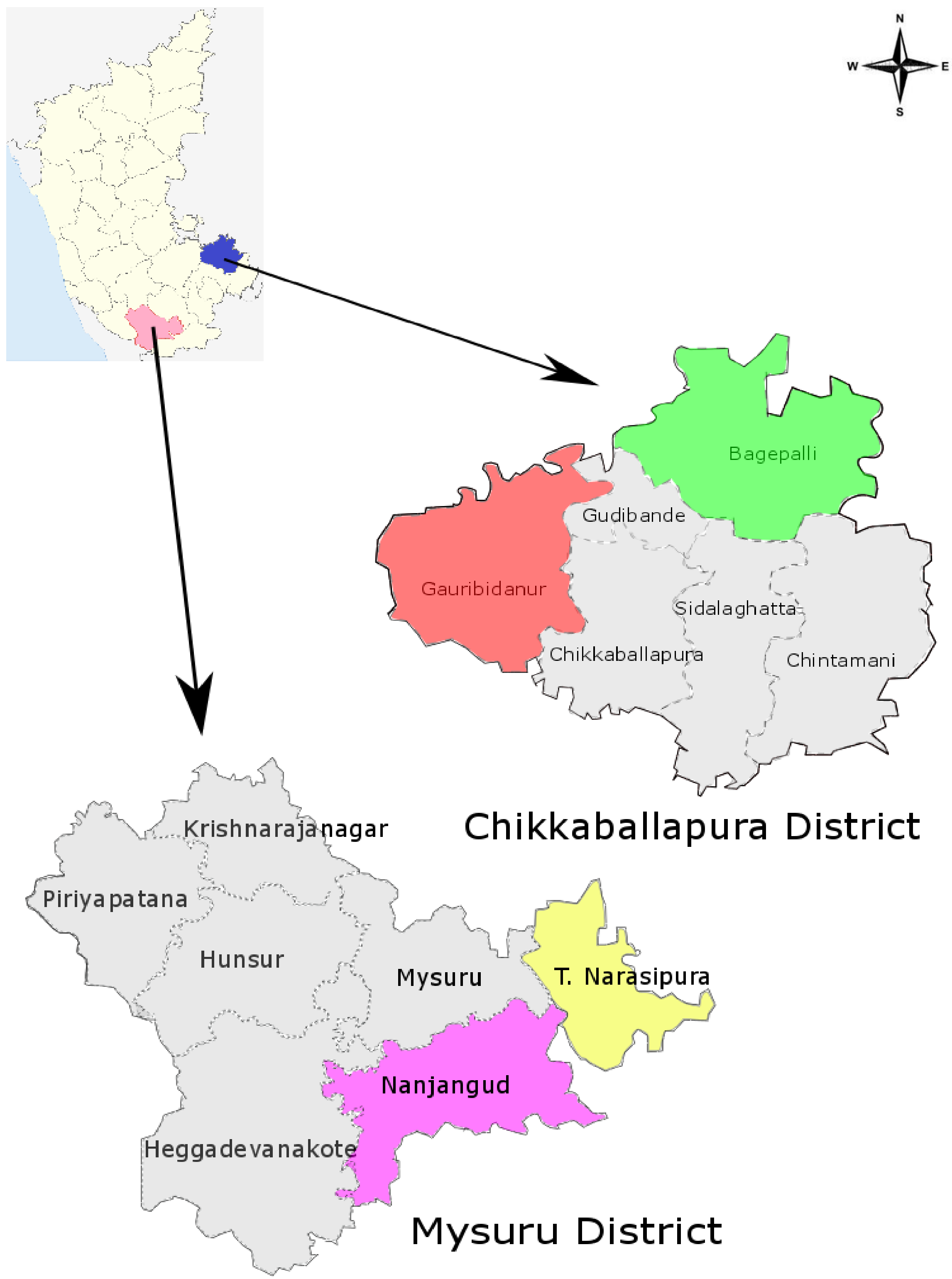

Fig. 3.1: Map showing the study area.

districts were selected for the study. As these varieties are the ruling varieties and occupy major portion in seed production as per the list provided by Karnataka State Seed Corporation limited. Thirty seed growers of each variety were selected and the data pertaining to agricultural production year 2016-17 was collected from the sample farmers.

3.3 Nature and sources of data

3.3.1 Primary data

The primary data was collected from 180 selected farmers. General information regarding size of land holdings, farm assets, costs and returns of crop, constraints in seed production and also the relevant data on variables required for evaluating the objectives of the study were collected from the farmers using pre-tested, well-structured schedule through personal interview method for the agricultural year 2016-17. The data collected were purely based on the memory of the respondents.

3.3.2 Secondary data

The data regarding demand and supply of certified seeds in Karnataka for the study were collected from the Department of Agriculture, Government of Karnataka, Bengaluru.

3.4 Analytical tools and techniques employed

To fulfil the objectives of the study, based on the nature and extent of availability of data, the following analytical tools and techniques have been adopted.

3.4.1 Estimation of costs and returns

The costs of inputs are classified into variable and fixed costs. Variable cost includes cost of input factors (seed, FYM, fertilizer, plant protection chemicals), labour cost and interest on working capital. Fixed cost includes depreciation on farm implements, rental value of land and interest on fixed farm implements. The measurement and definitions of various cost components are as follows,

A) Variable cost

Those costs which vary with the level of production are included in this category. The items included under this section are given below.

a) Labour cost

The cost of human labour was calculated by multiplying the man days with existing wage rate. Women days were converted into man days by multiplying it with the ratio of wages given to women labour to that of men labour. The cost on family labour was imputed by multiplying man days with the prevailing wage rate. The bullock labour was taken in pair days and the cost towards it was estimated by multiplying pair days with wage rate. Machine labour was measured in hours and valued at prevailing hourly rates in the study area.

b) Cost of inputs

Cost of various inputs like seeds, fertilisers, FYM and plant protection chemicals were included in this category. Non-farm inputs were valued at prevailing prices while owned farm inputs were imputed at current prices.

c) Irrigation cost

Ground water

The cost of electricity (subsidy by Government) to lift water from bore well was calculated using the following formula (3.5 is the cost of electricity per KWH),

Electricity charges = No. of irrigations x No. of hours irrigated per irrigation x Area x hp of motor x 0.75 KWH x 3.5 per KWH.

Amortization cost of bore well, pump and conveyance structure were calculated using the formula,

$$\text{Amortized cost} = \text{Initial investment} \times [(1+i)^{AL} \times i] \div [(1+i)^{AL}-1],$$

Where, AL- Average life of bore well, pump and other assets.

i - Discount rate.

Thus, irrigation cost was obtained by the summation of electricity charges and amortization cost

$$\text{Irrigation cost} = \text{Electricity charges} + \text{Amortized cost}$$

Surface water

Quantity of water = Number of irrigation × depth of irrigation (inch) × area of irrigation used (acre inch) (acre)

Nagaraj *et al*., (2002) estimated the price of surface water and was found it to be ₹ 12 per acre inch. To calculate the price of water used at present, the price of canal water in 2002 was compounded at two per cent interest rate to the present year which worked out to ₹ 16.15 per acre inch.

d) Interest on working capital

The prevailing bank rate of seven per cent (Commercial bank lending rate in study area) taken to work out the interest on working capital for the duration of the crop.

B) Fixed cost

This consists of those cost items which don't vary with the level of production. The items included under this section are,

a) Rental value of land

The prevailing rental value of the land for the crop depending on the duration of the crop was considered.

b) Depreciation

Depreciation on each capital equipment and machinery owned by the farmers were calculated separately, by using straight line method. The average life of the asset as indicated by each farmer was used in computation of the depreciation.

$$\text{Annual depreciation} = \frac{\text{Purchase value} - \text{Junk value}}{\text{Economic life of the asset}}$$

c) Interest on fixed capital

Interest on fixed capital was computed at the rate of ten per cent per annum. The interest was worked out on the values of fixed assets, after deducting depreciation for the year and land revenue.

d) Land revenue and taxes

Land revenue and taxes was charged at the rates levied by the Government.

C) Total cost

Total cost is the summation of total variable cost and total fixed cost.

D) Returns

a) Gross returns

Gross returns include returns from both the product accepted by the KSSC, and the product which was rejected by KSSC as it was not meeting the product standards and was sold to middle men or in the near-by markets, and it also includes the returns from the by-product imputed on the basis of post-harvest prices prevailing in the study area.

b) Net returns over total cost

Net return was computed by subtracting the gross returns from total cost of production of certified seeds.

c) Cost of production per quintal

Cost of production per quintal was worked out by dividing total cost of cultivation of certified seeds by the yield of main product.

d) Returns per rupee of expenditure

Return per rupee of expenditure was calculated by dividing the gross return by total cost of production of certified seeds.

3.4.2 Resource use efficiency

Cobb-Douglas type of production function was used to assess the resource use efficiency in seed production.

Specification of the equation for seed production is given in equation 1.

$$Y = a\, X_1^{b1}\, X_2^{b2}\, X_3^{b3}\, X_4^{b4}\, X_5^{b5} X_6^{b6} X_7^{b7} e^{u} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where,

Y = Gross returns (Rs)

X_1= Seed cost (Rs)

X_2= FYM cost (Rs)

X_3= Fertilizer cost (Rs)

X_4= Plant protection chemical cost (Rs)

X_5= Human labour cost (Rs)

X_6 = Machine labour cost (Rs)

X_7 = Area in acre

a = constant

u = random variable

b_1 to b_7 indicate regression coefficients of respective inputs and implicitly represents the elasticity of production of respective inputs.

The Cobb-Douglas production function was converted into natural log linear form. The log linear form of equation was

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + u \ln e \quad (2)$$

a) Allocative efficiency

Keeping technology as constant, farm is said to be efficient when resources are allocated efficiently according to market prices. To decide whether a particular input is used efficiently or not, its marginal value products is computed. If the marginal value product of an input just covers its acquisition cost, it is said to be used efficiently.

Marginal Value Product (MVP): The estimated coefficients were used to compute the MVP. We can assess the relative importance of factors of production by studying the marginal value product. Marginal Value Product of Xi, i.e., for the i^{th} input, it is estimated by the following formula,

$$\mathrm{MVP} = \mathrm{b_i} \times \frac{\mathrm{GM(Y)}}{\mathrm{GM(X_i)}}$$

G.M. (Y) and G.M. (Xi) represent the geometric means of output and input respectively and bi is the regression co- efficient of i^{th} input.

The model was estimated as follows,

r = MVP/MFC

where, r = efficiency ratio

MVP = Marginal value product of variable input

MFC = Marginal factor cost (price per unit input)

As all the variables are taken in cost terms, MFC will be one expect for the variable area which is taken in acres. The rental value of the area is taken as MFC.

Based on economic theory, a firm maximizes profits with regards to resource use when the ratio of the marginal return to the opportunity cost is one. The values are interpreted thus,

If r is <1; resource is excessively used or over utilized (no scope to increase) hence, decreasing the quantity of resource increases profits.

If r > 1; resource is under used or being underutilized (there is a scope to increase) hence, increasing its use will increase profit level.

If r = 1; it shows the resource is efficiently used, that is optimum utilization of resource, hence the point of profit maximization.

b) Technical efficiency

Technical efficiency (TE) defined as the ability of a farm to produce the maximum feasible output from a given level of inputs, or with the minimum feasible levels of inputs to produce the maximum level of output. Allocative efficiency (AE) refers to the ability of a technically efficient farm to use inputs in such combinations that minimize the production costs given input prices. Allocative efficiency is calculated as the ratio of minimum costs required by the farm to produce a given level of output and the actual costs of the farm adjusted for TE. Economic efficiency (EE) is the product of both TE and AE. Thus, a farm is economically efficient if it is both technically and allocatively efficient. The popular method of estimating the maximum possible output has been the *Data Envelopment Analysis* (DEA) advocated by Charnes *et al* (1978). The details are given below.

Data Envelopment Analysis: The DEA method is a frontier method that does not require specification of a functional form or a distributional form and can accommodate scale issues. DEA was applied by using both classic models CRS (constant returns to scale) with input orientation, in which one seeks input minimization to obtain a particular product level. (Coelli and Battese, 1998).

Estimation of technical efficiency

Min $\theta, \lambda\ \theta$,

Subject to $-yi + Y\lambda \geq 0$

$\theta Xi - X\lambda \geq 0$

$\lambda \geq 0$ ………………………………………………………. (3)

where,

yi is a vector (mx1) of output of the i^{th} Producing Farms (TPF)

xi is a vector (kx1) of inputs of the it^{h} TPF

Y is an output matrix (nxm) for n TPFs

X is an input matrix *(*n x k) for n TPFs θ is the efficiency score, a scalar whose value will be the efficiency measure for the i^{th} TPF. If θ=1, TFP (Total factor productivity) will be efficient; otherwise, it will be inefficient.

λ is a vector (nx1) whose values are calculated to obtain the optimum solution. For an inefficient TPF, the λ values will be the weights used in the linear combination of other efficient TPFs, which influence the projection of the inefficient TPF on the calculated frontier.

Estimation of Allocative and Cost Efficiency (Economic Efficiency)

If one has price information and is willing to consider a behavioural objective, such as cost minimization or revenue maximization, then one can measure both allocative and cost efficiencies. One would run the following DEA formula for estimation of efficiencies as follows:

$\text{Min}_{\lambda, X_i*}\ W_i X_i*,$

Subject to $\quad -y_i + Y\lambda \geq 0,$

$X_i * - X\lambda \geq 0,$

$N_1 \lambda \geq 1$

$\lambda \geq 0,$ ……………..………………………..…………… (4)

where,

W_i is a vector of input prices for the i^{th} Total Productivity Factor (TPF),

X_i is the cost minimizing vector of input quantities for the i^{th} RPF (which is calculated by the LP).

Given the input prices W_i and the output levels Y_i . The total Cost efficiency (CE) or Economic efficiency (EE) of the i^{th} TPF would be calculated as

$CE = W_i X_i * / W_i X_i$. ………………………………………………………………..(5)

i.e., the ratio of minimum cost to observed cost. One can then use following formula to calculate the allocative efficiency residually

AE= CE/TE. …………………..……………………………………………..…… (6)

Note that this procedure may include any slacks into the allocative efficiency measure. This is often justified on the grounds that slack reflects an appropriate input mix.

It is to state here that all the models presented above should be solved *n* times, i.e. the model is solved for each TPF in the sample. Gross yield (Q/ha) was used as a output(Y) in the present case and total labour (man days), bullock labour (bullock pair days), machine labour (hrs.), seeds (kg) and FYM (tractor load) as inputs(X). The models were solved using the DEAP version 2.1 taking an input orientation to obtain the efficiency levels.

3.4.3 Garrett ranking technique

Garrett's ranking technique was used to rank the constraints faced by the seed growers across the varieties i.e., IR-64 and Jyothi variety rice seed producing farmers, BRG-1 and BRG-2 varieties red gram producing farmers and KBSH-44 and KBSH-53 varieties of sunflower producing farmers in the study area.

The constraints were classified in to five groups namely, Production constraints, Marketing constraints, Agro-climatic constraints, Economic constraints and Institutional constraints by taking in to consideration the opinions of the sample farmers and with regard to various studies undertaken in the field of study.

Production constraints were further divided into general constraints, Plant protection constraints and credit constraints. General constraints contained lack of pure and quality seeds, lack of agricultural labour during peak seasons, lack of availability and high price of fertilizers, lack of availability of micro-nutrient fertilizers and lack of knowledge about recommended package of practices. Plant protection constraints included high incidence of diseases, high incidence of other insect pest and lack of availability of genuine plant protection chemicals. Credit constraints included lack of knowledge about sources, complex procedure, high transaction cost, timely unavailability and high interest rate.

Marketing constraints were further divided into lack of timely availability of genuine fertilizers, lack of timely availability of plant protection chemicals appliances, lack of storage facilities, lack of cheap and efficient transport and delay in payment by the procurement agencies.

Agro-climatic constraints includes inadequate variation in temperature, excessive rain and drought during critical stages of growth.

Economic constraints included high input cost, fixed price of procurement agency irrespective of market situation and Institutional constraints further included irregular power supply for farm activities, poor quality of inputs and poor Extension services

Each of the farmer was asked to rank the above factors from rank among the classified groups. In this analysis, rank one meant most important factor and higher the rank meant least important factor. In the next stage, rank assigned to each factor by each individual was converted into per cent position using the following formula,

$$\text{Per cent position} = \frac{100 \times (R_{ij} - 0.50)}{N_j}$$

where,

R_{ij} stands for rank given for the i^{th} factor (i= 1, 2……9) by the j^{th} individual (j = 1, 2 …..50)

N_j stands for number of factors ranked by j^{th} individual.

Once the per cent positions were found, the per cent position of each rank was converted to scores by referring to table given in Garrett and Woodsworth (1969). Then the scores for each factor were summed over the number of sample farmers who ranked that factor. In this way, total scores were arrived at for each of the constraints and mean scores were calculated by dividing the total score by the number of respondents, who gave ranks. Finally, overall ranking of the constraints was done by assigning rank 1, 2, 3,… etc in the descending order of the mean scores.

IV RESULTS AND DISCUSSION

The findings of the study are presented in this chapter under the following headings in consonance with the objectives of the study.

4.1 Socio-economic characteristics of respondent farmers

4.2 Farm assets inventory

4.3 Cost and returns of seed production

4.4 Resource and labour utilization pattern in seed production

4.5 Resource-use efficiency in seed production

4.6 Requirement and availability of quality seeds

4.7 Benefits and constraints faced by farmers in seed production

4.1 Socio-economic characteristics of respondent farmers

4.1.1 Socio-economic characteristics of rice seed producing farmers

The general characteristics of the rice seed producing farmers indicated that majority of the seed producing farmers belonged to old age group (>50 years) in both the varieties i.e. 53.33 and 60 per cent, followed by 43.33 per cent and 30 per cent of farmers falling in the age group of 35-50 years in IR-64 and Jyothi varieties, respectively. The average age of farmers was 52 and 53 years, respectively in case of IR-64 and Jyothi seed producing farmers and there was no significant difference in average age (Table 4.1).

The classification of the farmers according to their education level revealed that majority of farmers had high school education (33.33 %) followed by illiterate farmers (26.67 %), pre-university studies (20 %), primary school education (13.33 %) and two among respondents were graduated in case of IR-64 variety (Table 4.1). In Jyothi variety seed growing farmers also majority of the farmers had high school education (30 %), followed by farmers with pre-university studies (23.33 %), further equal portion of illiterate and graduate farmers were found in the sample. There was no significant difference among the farmers with regard to average education status.

Table 4.1: Socio-economic characteristics of farmers taking up rice seed production in Mysuru district.

Sl. No.	Particulars	IR-64 (n=30)	Jyothi (n=30)	't' value
A	**Age of farmers (No.)**			
1	Below 35 years	1 (3.33)	3 (10.00)	
2	35-50 years	13 (43.33)	9 (30.00)	
3	Above 50 years	16 (53.33)	18 (60.00)	
	Average age (Years)	52	53	0.69^{NS}
B	**Education level (No.)**			
1	Illiterate	8 (26.67)	5 (16.67)	
2	Primary	4 (13.33)	4 (13.33)	
3	High School	10 (33.33)	9 (30.00)	-0.98^{NS}
4	College	6 (20.00)	7 (23.33)	
5	Degree and above	2 (6.67)	5 (16.67)	
C	**Family size (No.)**			
1	Small (<4 number)	1 (3.33)	3 (10.00)	
2	Medium (4-6 number)	16 (53.33)	14 (46.67)	
3	Large (>6 number)	13 (43.33)	13 (43.33)	
	Average family size	6	6	1.49^{NS}
D	**Land holding (No.)**			
1	Small farmers (< 2 ha)	10 (33.33)	3 (10.00)	
2	Medium farmers (2-5 ha)	20 (66.67)	25 (83.33)	
3	Large farmers (>5 ha)	0 (0.00)	2 (6.67)	
	Average land holding size	5.5	6.2	-1.15^{NS}

Note: Figures in parentheses are in percentage

Classification of farmers on the basis of family size indicated that, majority of sample farmers in seed production of both the varieties were having medium sized family (53.33 % and 46.67 % in IR-64 and Jyothi, respectively), followed by large family size farmers (43.33 % and 43.33 %, in IR-64 and Jyothi, respectively) and only one sample respondent had small family of size less than four members in the case of IR-64 variety but in case of Jyothi 10 per cent of farmers had small families. The socio-economic characteristics clearly reflect that, farmers producing rice seeds are homogeneous in Mysuru district.

With respect to land holding, majority of farmers had medium (66.67 % and 83.33 %, in IR-64 and Jyothi, respectively) land holdings ranging between two to five hectares (Table 4.1), followed by small farmers having less than two hectares in both the cases and none of the farmers in case of IR-64 variety rice farmers had more than five hectares but two respondents of Jyothi variety rice seed producing farmers had more than five hectares. The average land holding was 5.5 and 6.2 hectares for IR-64 and Jyothi variety seed producing farmers and the difference in average area was found non-significant.

4.1.2 Socio-economic characteristics of redgram seed producing farmers

The general characteristics of the sample redgram seed producing farmers indicated that majority of seed producing farmers belongs to old age group (>50 years) in BRG-1 variety followed by farmers of age 35-50 years (43.33 %) and 10 per cent of farmers below 35 years, in case of BRG-2 variety majority of famers were of age between 35 to 50 years (70 %) followed by farmers aged more than 50 years (16.67 %) and four per cent had age less than 35 years (Table 4.2).

The classification of the red gram seed growing farmers according to their education level revealed that majority of farmers were illiterate in both the varieties BRG-1 and BRG-2 (43.33 % and 40 %, respectively) followed by farmers with high school education (26.67 % and 30 %, respectively) and only one among both the varieties were graduated.

Table 4.2: Socio-economic characteristics of farmers taking up red gram seed production in Chikkaballapura district.

Sl. No	Particulars	BRG-1 (n=30)	BRG-2 (n=10)	't' value
A	**Age of farmers (No.)**			
1	Below 35 years	3 (10.00)	4 (13.33)	
2	35-50 years	13 (43.33)	21 (70.00)	
3	Above 50 years	14 (46.67)	5 (16.67)	
	Average age (years)	50.04	44.24	1.78 NS
B	**Education level (No.)**			
1	Illiterate	13 (43.33)	12 (40.00)	
2	Primary	4 (13.33)	4 (13.33)	
3	High School	8 (26.67)	9 (30.00)	-1.98 NS
4	College	4 (13.33)	4 (13.33)	
5	Degree and above	1 (3.33)	1 (3.33)	
C	**Family size (No.)**			
1	Small (<4 number)	3 (10.00)	2 (6.67)	
2	Medium (4-6 number)	16 (53.33)	23 (76.67)	
3	Large (>6 number)	11 (36.67)	5 (16.67)	
	Average family size	5	6	-1.07 NS
D	**Land holding (No.)**			
1	Small farmers (< 2 ha)	19 (63.33)	21 (70.00)	
2	Medium farmers (2-5 ha)	9 (30.00)	7 (23.33)	
3	Large farmers (>5 ha)	2 (6.67)	2 (6.67)	
	Average land holding size	3.4	3.26	0.82 NS

Note: Figures in parentheses are in percentage

Based on family size, it was found that (Table 4.2) majority of the farmers in both the varieties were having medium sized family (53.33 % and 76.67 %.), followed by large family size farmers (36.67 % and 16.67 %, respectively).

With respect to land holding, majority of the farmers were small farmers (63.33 % and 70 %, respectively) with land holding of less than two hectare, followed by medium farmers having land holding between two hectares to five hectare and two among both varieties were large farmers having the holding size of more than five hectare (Table 4.2). The socio-economic characteristics clearly reflect that, farmers producing redgram seeds are homogeneous in Chikkaballapura district.

4.1.3 Socio-economic characteristics of sunflower seed producing farmers

The general characteristics of the sample sunflower seed producing farmers indicated that 20 and 15 farmers belonged to old age group in KBSH-44 and KBSH-53 varieties (66.67 % and 50 %, respectively) followed by farmers falling under the age group of 35-50 years. In both the varieties KBSH-44 and KBSH-53, only two and four farmers were belonging to young age group, respectively (Table 4.3).

The education level revealed that majority of the farmers were illiterate in both the varieties KBSH-44 and KBSH-53 (33.33 % and 36.67 %, respectively) followed by farmers with high school education (23.33 % and 26.67 %, respectively) and four and two farmers of KBSH-44 and KBSH-53 varieties, respectively were graduated. Sunflower seed growers of both the varieties had large family size with more than six members in a family followed by small (30 %) and medium (20 %) family size farmers in KBSH-44 variety and medium (40 %) and small (16.67 %) family size having farmers in KBSH-53 variety.

The land holding among sunflower seed growing farmers was small, 83.33 per cent and 76.67 per cent of farmers had less than two hectares in KBSH-44 and KBSH-53 varieties, respectively. None of the sample farmers of KBSH-44 variety had more than five hectares in KBSH-44 and only one farmer of KBSH-53 had more than five hectares of land holding in the study area. The socio-economic characteristics clearly reflect that, farmers producing sunflower seeds are homogeneous in Chikkaballapura district.

Table 4.3: Socio-economic characteristics of farmers taking up sunflower seed production in Chikkaballapura district.

Sl. No.	Particulars	KBSH-44 (n=30)	KBSH-53 (n=30)	't' value
A	**Age of farmers (No.)**			
1	Below 35 years	2 (6.67)	4 (13.33)	
2	35-50 years	8 (26.67)	11 (36.67)	
3	Above 50 years	20 (66.67)	15 (50.00)	
	Average age (years)	53.2	55.6	1.48^{NS}
B	**Education level (No.)**			
1	Illiterate	10 (33.33)	11 (36.67)	
2	Primary (1-7)	3 (10.00)	5 (16.67)	
3	High School (8-10)	7 (23.33)	8 (36.67)	1.8^{NS}
4	College (11-12)	6 (20.00)	4 (13.33)	
5	Degree and above	4 (13.33)	2 (6.67)	
C	**Family size (No.)**			
1	Small (<4)	9 (30.00)	5 (16.67)	
2	Medium (4-6)	6 (20.00)	12 (40.00)	-0.70^{NS}
3	Large (>6)	15 (50.00)	13 (43.33)	
	Average family size	7	7	-0.70^{NS}
D	**Land holding (No.)**			
1	Small farmers (below 2 ha)	25 (83.33)	23 (76.67)	
2	Medium farmers (2-5 ha)	5 (16.67)	6 (20.00)	
3	Large farmers (5 ha)	0 (0)	1 (3.33)	
	Average land holding size	2.95	3.12	-1.79^{NS}

Note: Figures in parentheses are in percentage

4.2 Farm assets inventory

With regard to farm assets, both in IR-64 (63.33 %) and Jyothi (70 %) varieties majority of farmers possessed sprayers. The farmers of Jyothi variety having irrigation pump were more (63 %) compared to IR-64 (40 %) and this was significant at five per cent. The difference in possession of other farm assets except irrigation pump was non-significant (Table 4.4).

Table 4.4: Possession of major farm machinery/ equipment's/ assets by rice seed producing farmers in the study area

Sl. No.	Particulars	IR-64 (n=30)	Jyothi (n=30)	't' value
1	Irrigation pump (IP set)	12 (40.00)	19 (63.33)	2.69*
2	Bullock cart	7 (23.33)	5 (16.66)	0.62 NS
3	Ploughs	6 (20.00)	4 (13.33)	0.70 NS
4	Seed drill	5 (16.66)	7 (23.33)	-0.62 NS
5	Sprayer	19 (63.33)	21 (70.00)	0.57 NS
6	Cultivator	5 (16.66)	6 (20.00)	-0.32 NS
7	Cattle shed	3 (10)	6 (20.00)	-1.14NS
8	Farm building	5 (16.66)	8 (26.66)	-0.90 NS
9	Tractor	17 (56.66)	15 (50.00)	0.57 NS
10	Power tiller and accessories	9 (30.00)	7 (23.33)	0.62 NS
11	Harvester	3 (10)	2 (6.66)	0.44 NS
12	Thresher	2 (6.66)	0 (0.00)	1.43 NS

Note: *- Significance at 5 percent

Figures in parentheses are in percentage

In case of red gram (Table 4.5) seed producers also majority of farmers had sprayers in both BRG-1 and BRG-2 varieties (73.33 % and 86.66 %) and the difference was non-significant. The difference in possession of seed drill and tractor were significant, more number of farmers producing BRG-1 variety had seed drills (73.33) and more number of farmers producing BRG-2 variety had tractors (23.33 %).

Table 4.5: Possession of major farm machinery/ equipment's/ assets by red gram seed producing farmers in the study area

Sl. No.	Particulars	BRG-1 (n=30)	BRG-2 (n=30)	't' value
1	Irrigation pump (IP set)	16 (53.33)	19 (63.33)	-1.14 NS
2	Bullock cart	2 (6.66)	2 (6.66)	0.00 NS
3	Ploughs	2 (6.66)	4 (13.33)	-1.00 NS
4	Seed drill	12 (40)	5 (16.66)	2.24**
5	Sprayer	22 (73.33)	26 (86.66)	-1.43 NS
6	Cultivator	3 (10.0)	4 (13.33)	-0.44 NS
7	Cattle shed	6 (20)	2 (6.66)	1.68NS
8	Farm building	2 (6.66)	5 (16.66)	-1.14 NS
9	Tractor	13 (43.33)	7 (23.33)	2.26**
10	Power tiller and accessories	8 (26.66)	4 (13.33)	1.43 NS

Note: **- Significance at 5 per cent

Figures in parentheses are in percentage

In case of sunflower seed producers (Table 4.6), the difference in the possession of assets was not significant. The farmers of KBSH-44 variety found much mechanised with more number of cultivators (20 %), tractors (43 %), power tillers and accessories (30 %) compared to farmers producing KBSH-53 variety.

Table 4.6: Possession of major farm machinery/ equipment's/ assets by sunflower seed producing farmers in the study area (Numbers)

Sl. No.	Particulars	KBSH-44 (n=30)	KBSH-53 (n=30)	't' value
1	Irrigation pump (IP set)	23 (76.66)	24 (80.00)	-0.29 NS
2	Bullock cart	4 (13.33)	8 (26.66)	-1.43 NS
3	Ploughs	11 (36.66)	14 (46.66)	-0.76 NS
4	Seed drill	8 (26.66)	9 (30.00)	-0.27 NS
5	Sprayer	15 (50.00)	18 (60.00)	-1.14 NS
6	Cultivator	6 (20.00)	5 (16.66)	0.32 NS
7	Cattle shed	2 (6.66)	4 (13.33)	1.00NS
8	Farm building	8 (26.66)	4 (13.33)	-1.27 NS
9	Tractor	13 (43.33)	9 (30.00)	1.43 NS
10	Power tiller and accessories	9 (30.00)	6 (20.00)	-0.82 NS

Note: Figures in parentheses are in percentage

4.3 Cost and returns of seed production

The details on the costs incurred on variable factors and fixed factors in rice, red gram and sunflower seed production were estimated and are presented below.

4.3.1 Cost and returns in rice seed production

Cost structure in rice seed production

Working costs: It can be observed from Table 4.7 and 4.9, that the average working expenses incurred in IR-64 and Jyothi varieties of rice seed production was Rs 85,509 per ha and Rs 87,900 per ha, respectively. Working expenses constituted 75.86 per cent and

76.42 per cent in IR-64 and Jyothi varieties, respectively. In IR-64 variety of rice seed production, the major cost item was the cost on human labour (30.90 %), followed by machine labour (18.92 %) FYM (10.70 %), fertilizer (6.28 %), interest on working capital (2.57 %) and seeds (2.54 %). In Jyothi variety of rice seed production, expenditure on human labour (25.30 %), followed by cost on machine labour (23.93 %) FYM (7.18 %), fertilizer (7.00 %), plant protection chemical costs (5.26 %) and interest on working capital (2.58 %) were found important.

As the labour cost in both the varieties IR-64 (30.90 %) and Jyothi (25.30 %) is more than 25 per cent of total cost of cultivation. The hypothesis "In seed production, labour cost forms more than 25 per cent of cost of cultivation" is accepted.

Fixed costs: Fixed costs accounted for 24.14 per cent and 23.58 per cent of the total cost of cultivation in IR-64 and Jyothi varieties of rice seed production, respectively. Among fixed cost, rental value of land was major chunk in both IR-64 (21.93 %) and Jyothi (21.33 %) varieties. The average fixed cost ₹ 20,638 per ha and ₹ 20,705 per ha in IR-64 and Jyothi varieties, respectively (Tables 4.7 and 4.9).

Cost of cultivation: The average cost of cultivation of IR-64 and Jyothi varieties of rice seed production was Rs 85,509 and Rs 87,900 per hectare, respectively. Of the total cost of cultivation, the variable cost was more than fixed cost in both the varieties.

Returns from rice seed production

Yield and gross returns: The gross return includes returns from main product (accepted and rejected seeds) as well as by-product (straw) and the details are presented in Tables 4.8 and Table 4.10. The average accepted seed yield obtained per hectare in IR-64 and Jyothi varieties of rice was 59.68 quintals and 54.78 quintals, respectively. The seeds rejected by the KSSC because of not meeting the product standards in IR-64 and Jyothi was 9.16 q and 7.66 q, respectively. Per hectare gross returns were ₹ 1,53,631and ₹ 1,65,507in IR-64 and Jyothi.

Net return: The analysis of net return from IR-64 and Jyothi varieties of rice seed production revealed that the net return per hectare was ₹ 67,809 and ₹ 77,607, respectively. The cost of production was high in Jyothi seed production (₹ 1,408 per quintal) compared to that of IR-64 seed production (₹ 1,242 per quintal). Hence the hypothesis, there is no difference in cost of production across varieties was rejected.

Returns per rupee of expenditure: The return per rupee of expenditure incurred in rice seed production was higher in case of Jyothi variety (₹ 1.88) than in IR-64 variety (₹ 1.80) hypothesis that return per rupee do not differ in cost of seed production across varieties is rejected.

The cost of production was high in Jyothi variety (₹ 1,408 /q) compared to IR-64 (₹ 1,242 /q) because of the cost incurred on plant protection chemicals was more as the variety is prone to diseases and pests as observed in the study area, Jyothi variety fetches high market rate for both accepted and rejected products from KSSC, hence the net returns were more (₹ 77,607) (Table 4.10).

The cost structure revealed that, labour was the major cost incurred in seed production. Similar observations were made by Ramrao (2012). The comparison of seed production to conventional production (Table 4.19) showed the win-win condition for seed producing farmers by realising higher yield and returns compared to conventional production (Satishkumar, 2017) which resulted less net returns (₹ 39,854) and return per rupee of expenditure (₹ 1.52), respectively.

The results revealed a significant difference in cost of production, between varieties (Table 4.19). Hence, the hypothesis that, there is no difference in cost of seed production across varieties was rejected.

Table 4.7: Cost of cultivation of certified seed production of IR-64variety of rice

(Per ha)

Sl. No.	Particulars	Qty	Unit cost (₹)	Cost (₹)	%
I	**Variable cost**				
	Seeds (kg)	65.77	33	2,170	2.54
	FYM (tractor load)	4.21	2,173	9,149	10.70
	Fertilizer cost (₹)	-	-	5,371	6.28
	Plant protection chemical cost (₹)	-	-	995	1.16
	Labour (Man days)	88	300	26,426	30.90
	Machine Labour cost (₹)	-	-	16,179	18.92
	Bullock Labour (BP days)	1.24	620	771	0.90
	Irrigation (acre inches)	100	16.5	1,615	1.89
	Interest on working capital @ 7 %	-	-	2,194	2.57
	Total variable cost	-	-	64,871	75.86
II	**Fixed cost**				
	Depreciation	-	-	1,764	2.06
	Land revenue	-	-	35	0.04
	Interest on fixed capital @ 10 %	-	-	89	0.10
	Rental value of land	-	-	18,750	21.93
	Total fixed cost	-	-	20,638	24.14
III	**Total cost of cultivation (I+II)**			85,509	100

Table 4.8: Returns from certified seed production of IR-64 variety of rice

(Per ha)

Returns	Quantity	Unit price (₹)	Value (₹)
Main product			
a) Accepted product (q)	59.68	2,200	1,31,296
b) Rejected product (q)	9.16	1,650	15,114
By product			7,221
Gross returns	-	-	1,53,631
Net returns	-	-	67,809
Cost of production (/q)	-	-	1,242
Returns per quintal	-	-	2,127
Returns per rupee of expenditure	-	-	1.80

Table 4.9: Cost of cultivation of certified seed production of Jyothi variety of rice

(Per ha)

Sl. No.	Particulars	Qty.	Unit cost (₹)	Cost (₹)	%
I	**Variable cost**				
	Seeds (kg)	73.6	38	2,797	3.18
	FYM (tractor load)	2.9	2,175	6,308	7.18
	Fertilizer cost (₹)	-	-	6,153	7.00
	Plant protection chemical cost	-	-	4,625	5.26
	Labour (Man days)	68	327	22,236	25.30
	Machine Labour cost	-	-	21,038	23.93
	Bullock Labour (BP days)	0.2	662	132	0.15
	Irrigation (acre inches)	-	16.5	1,615	1.84
	Interest on working capital @ 7 %	-	-	2,307	2.58
	Total variable cost			67,175	76.42
II	**Fixed cost**				
	Depreciation	-	-	1,846	2.10
	Land revenue	-	-	35	0.04
	Interest on fixed capital @ 10 %	-	-	94	0.11
	Rental value of land	-	-	18,750	21.33
	Total fixed cost	-	-	20,725	23.58
III	**Total cost of cultivation (I+II)**			87,900	100.00

Table 4.10: Returns from certified seed production of Jyothi variety of rice

(Per ha)

Returns	Quantity	Unit price (₹)	Value (₹)
Main product			
A) Accepted product (q)	54.78	2,500	1,36,950
B) Rejected product (q)	7.66	2,243	17,181
By product			11,376
Gross returns	-	-	1,65,507
Net returns	-	-	77,607
Cost of production (/q)	-	-	1,408
Returns per quintal	-	-	2,468
Returns per rupee of expenditure	-	-	1.88

4.3.2 Cost and returns in Red gram seed production

Cost structure in Red gram seed production

Working costs: It can be observed from the Table 4.11 and 4.13 that the average working expenses incurred in BRG-1 and BRG-2 varieties of red gram seed production was ₹ 42,671 per ha and ₹ 35,560 per ha, respectively. Working expenses constituted 72.34 per cent and 68.69 per cent in BRG-1 and BRG-2 varieties of red gram, respectively. In BRG-1 variety of red gram seed production, the major cost item in working cost were cost on human labour cost (32.55 %) followed by cost on machine labour (12.59 %), FYM (11.36 %), fertilizers (6.99 %). In BRG-2 variety of red gram seed production, expenditure on human labour cost (34.19 %) was major, followed by cost on FYM (9.09 %), machine labour (8.97 %) and fertilizers (6.96 %).

As the labour cost in both the varieties BRG-1 (32.55 %) and BRG-2 (34.19 %) is more than 25 per cent of total cost of cultivation. The hypothesis "In seed production, labour cost forms more than 25 per cent of cost of cultivation" is accepted.

Fixed costs: Fixed costs accounted for 27.66 per cent and 31.31 per cent of the total cost of cultivation in BRG-1 and BRG-2 varieties of red gram seed production. Among fixed cost, rental value of land was major chunk in both BRG-1 (25.43 %) and BRG-2 (28.98 %) varieties of red gram seed production. The average fixed cost ₹ 16,318 per ha and ₹ 16,208 per ha in BRG-1 and BRG-2 varieties of red gram seed production. (Tables 4.11 and 4.13).

Cost of cultivation: The average cost of cultivation of BRG-1 and BRG-2 varieties of red gram seed production was ₹ 58,989 and ₹ 51,768 per hectare, respectively. Of the total cost of cultivation, the variable cost was more than fixed cost in both the varieties.

Cost structure in red gram seed production

Returns from Red gram seed production

Yield and gross returns: The gross return includes returns from accepted seeds and rejected seeds and the details are presented in Table 4.12 and Table 4.14. The average seed yield obtained per hectare of BRG-1 and BRG-2 varieties of red gram seed production was

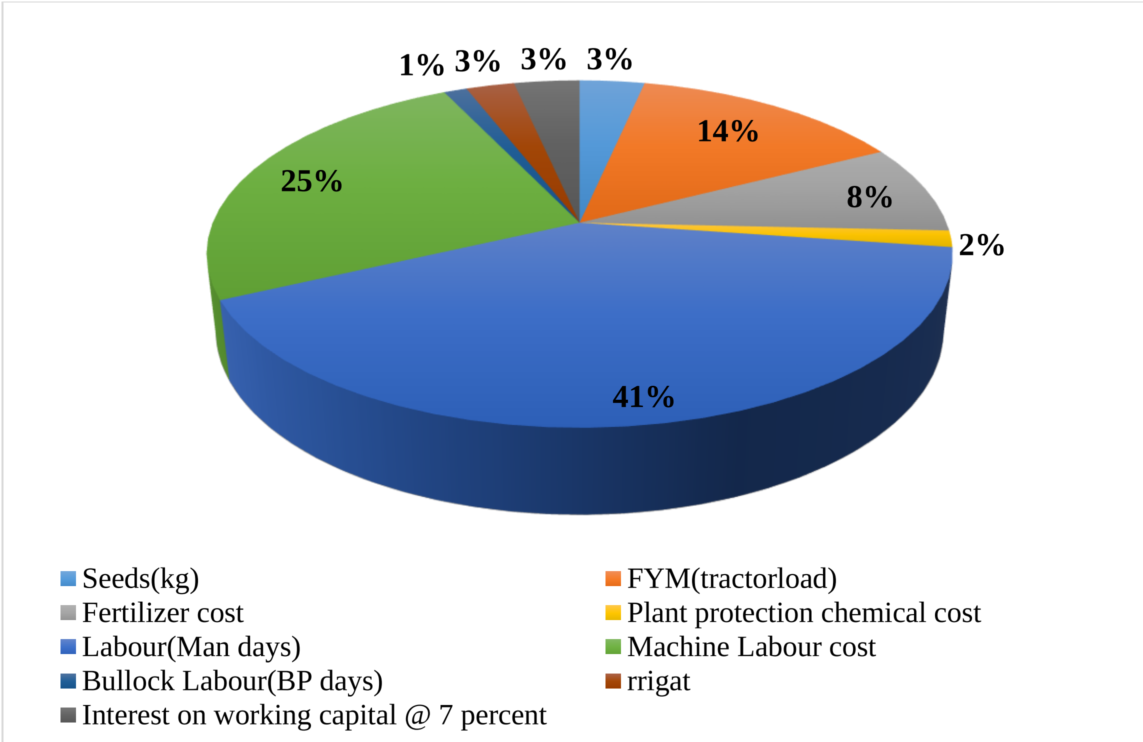

Fig. 4.1 Share of variable cost in IR-64 rice seed production

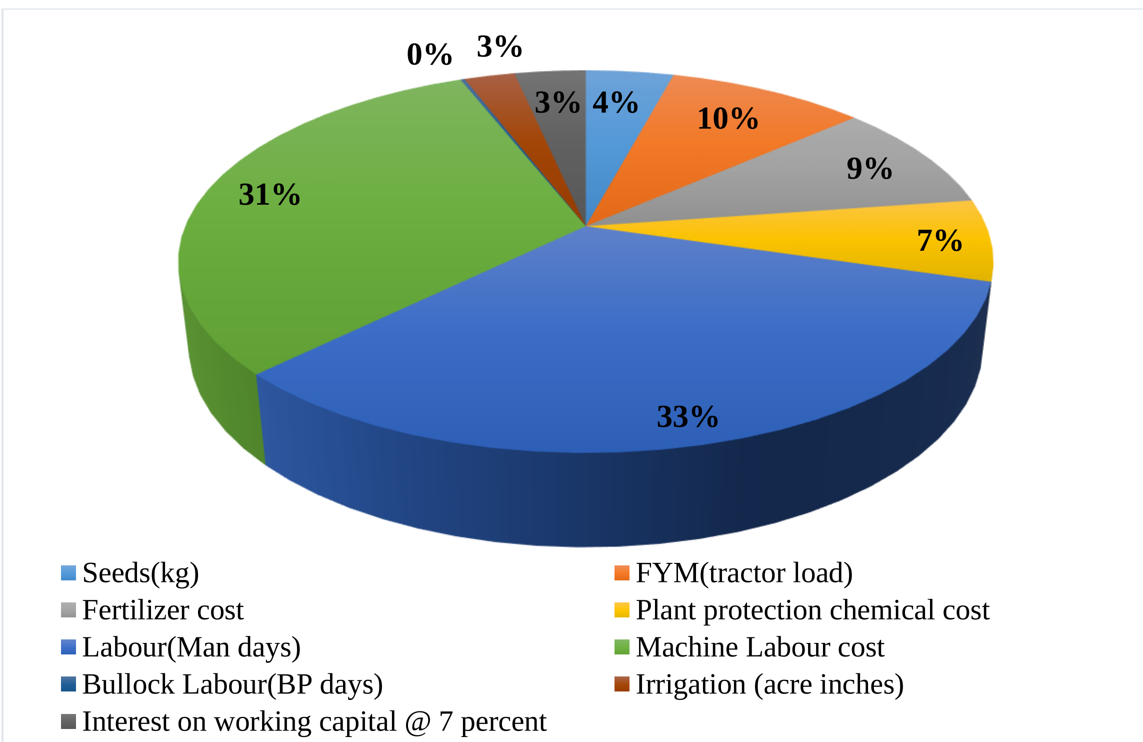

Fig. 4.2 Share of variable cost in Jyothi rice seed production

13.2 q and 11.3 q, respectively which was accepted by KSSC. The average yield of rejected product by KSSC was 2.2 q and 2.4 q, respectively. Per hectare gross returns were ₹ 92,935 and ₹ 80,890 in BRG-1 and BRG-2 varieties of red gram seed production, respectively.

Net return: The analysis of net return from BRG-1 and BRG-2 varieties of red gram seed production revealed that the net return per hectare was ₹ 33,946 and ₹ 29,122, respectively. The cost of production was high in BRG-2 seed production (₹ 3,830 /q) compared to that of BRG-1 seed production. (₹ 3,779 /q).

Returns per rupee of expenditure: The rate of return per rupee of expenditure incurred in red gram seed production was higher in case of BRG-1 variety (₹ 1.58) than in BRG-2 variety (₹ 1.56). Since there is difference in the returns per of expenditure, hypothesis of no difference in return per rupee of expenditure across varieties is rejected.

The cost structure of both the varieties showed that, the cost on labour is more than 25 per cent, Jamadar reported similar observation in his study. The results revealed a significant difference in cost of production, between varieties (Table 4.19). Hence, the hypothesis that, there is no difference in cost of seed production across varieties was rejected.

The comparison of seed production to conventional production (Table 4.19) indicated higher returns in seed production in both the varieties. The returns per rupee of expenditure was ₹ 1.49 in conventional production (Akshatha, 2017) which was lower when compared to return per rupee of expenditure in BRG-1 (₹ 1.58) and BRG-2 (₹ 1.56) seed production. The results revealed that the seed production is profitable than grain production, the findings were conformity with Pal (2016). BRG-2 yielded lower returns and quantity compared to BRG-1 because of drought condition during critical stages the seed setting was not optimally met, hence the yield was decreased.

Table 4.11: Cost of cultivation of certified seed production of BRG-1 variety of red gram (Per ha)

Sl. No.	Particulars	Qty.	Unit cost (₹)	Cost (₹)	%
I	**Variable cost**				
	Seeds (kg)	12.8	73	935	1.59
	FYM (tractor load)	2.9	2310	6,699	11.36
	Fertilizer cost (₹)	-	-	4,123	6.99
	Plant protection chemical cost (₹)	-	-	852	1.44
	Labour (Man days)	64	300	19,200	32.55
	Machine Labour cost (₹)	-	-	7,426	12.59
	Bullock Labour (BP days)	2.12	940	1,993	3.38
	Interest on working capital @ 7 %	-	-	1,443	2.45
	Total variable cost			42,671	72.34
	Fixed cost				
II	Depreciation			1,230	2.09
	Land revenue	-	-	25	0.04
	Interest on fixed capital @ 10%	-	-	63	0.11
	Rental value of land	-	-	15,000	25.43
	Total fixed cost	-	-	16,318	27.66
III	**Total cost of cultivation (I+II)**			**58,989**	**100.00**

Table 4.12: Returns from certified seed production of BRG-1 variety of redgram

(Per ha)

Returns	Quantity	Unit price (₹)	Value (₹)
Main product			
a) Accepted product (q)	13.2	6,500	85,800
b) Rejected product (q)	2.2	3,243	7,135
Gross returns	-	-	92,935
Net returns	-	-	33,946
Cost of production (/q)	-	-	3,830
Return per quintal	-	-	6,035
Returns per rupee of expenditure	-	-	1.58

Table 4.13: Cost of cultivation of certified seed production of BRG-2 variety of redgram (Per ha)

Sl. No.	Particulars	Qty	Unit cost (₹)	Cost (₹)	%
I	**Variable cost**				
	Seeds (kg)	12.7	73	924	1.78
	FYM (tractor load)	2.1	2,240	4,704	9.09
	Fertilizer cost (₹)	-	-	3,601	6.96
	Plant protection chemical cost (₹)	-	-	903	1.74
	Labour (Man days)	59	300	17,700	34.19
	Machine Labour cost (₹)	-	-	4,646	8.97
	Bullock Labour (BP days)	2.14	890	1,905	3.68
	Interest on working capital @ 7 %	-	-	1,177	2.27
II	Total variable cost	-	-	35,560	68.69
	Fixed cost				
	Depreciation	-	-	1,125	2.17
	Land revenue	-	-	25	0.05
	Interest on fixed capital @ 10 %	-	-	58	0.11
	Rental value of land	-	-	15,000	28.98
	Total fixed cost	-	-	16,208	31.31
III	**Total cost of cultivation (I+II)**			**51,768**	**100.00**

Table 4.14: Returns from certified seed production of BRG-2 variety of redgram
(Per ha)

Returns	Quantity	Unit price (₹)	Value (₹)
Main product			
a) Accepted product (q)	11.3	6,500	73,450
b) Rejected product (q)	2.4	3,100	7,440
Gross returns	-	-	80,890
Net returns	-	-	29,122
Cost of production (/q)	-	-	3,779
Returns per quintal	-	-	5,904
Returns per rupee of expenditure	-	-	1.56

4.3.3 Cost and returns in Sunflower seed production

Cost structure in Sunflower seed production

Working costs: From the Tables 4.15 and 4.17 it was observed that the average working expenses incurred in KBSH-44 and KBSH-53 varieties of sunflower seed production was ₹ 86,208 per ha and ₹ 86,507 per ha, respectively. Working expenses constituted about 83.74 per cent and 83.72 per cent in KBSH-44 and KBSH-53 varieties of sunflower, respectively. In KBSH-44 variety, the major cost item in working cost was the cost on human labour cost (49.25 %) followed by FYM (10.10 %) and fertilizers (8.07 %). In KBSH-53 variety, expenditure on human labour (50.23 %) was major, followed by cost on FYM (9.09 %), fertilizers (7.56 %) and machine labour (5.29 %).

As the labour cost in both the varieties KBSH-44 (49.25 %) and KBSH-53 (50.23 %) is more than 25 per cent of total cost of cultivation. The hypothesis “In seed production, labour cost forms more than 25 per cent of cost of cultivation” is accepted.

Fixed costs: Fixed costs accounted for 16.26 and 16.28 per cent of the total cost of cultivation in KBSH-44 and KBSH-53 varieties, respectively. Among fixed costs, rental value of land was major in both KBSH-44 (14.57 %) and KBSH-53 (14.52 %) varieties. The average fixed cost was ₹ 16,741 per ha and ₹ 16,822 per ha in KBSH-44 and KBSH-53 varieties.

Cost of cultivation: The average cost of cultivation of KBSH-44 and KBSH-53 varieties of sunflower seed production was ₹ 1, 02,949 and ₹ 1, 03,329 per hectare, respectively. Of total cost of cultivation, the variable cost more (83 %) rather than fixed cost in both the varieties.

Returns from Sunflower seed production

Yield and gross returns: The gross return includes returns from accepted seeds and rejected seeds and also returns from seeds of male lines (Table 4.16 and Table 4.18). The average seed yield obtained per hectare of KBSH-44 and KBSH-53 varieties was 13.2 quintals and 12.4 quintals, respectively which was accepted by KSSC. The average yield

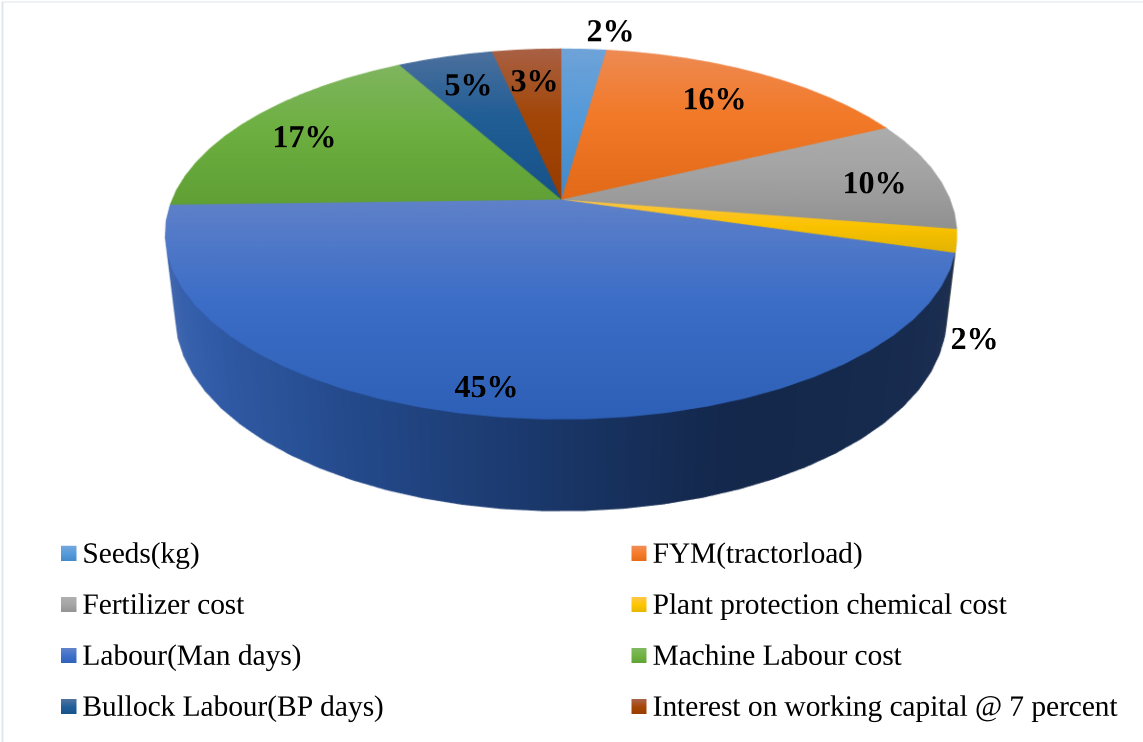

Fig. 4.3 Share of variable cost in BRG-1 redgram seed production

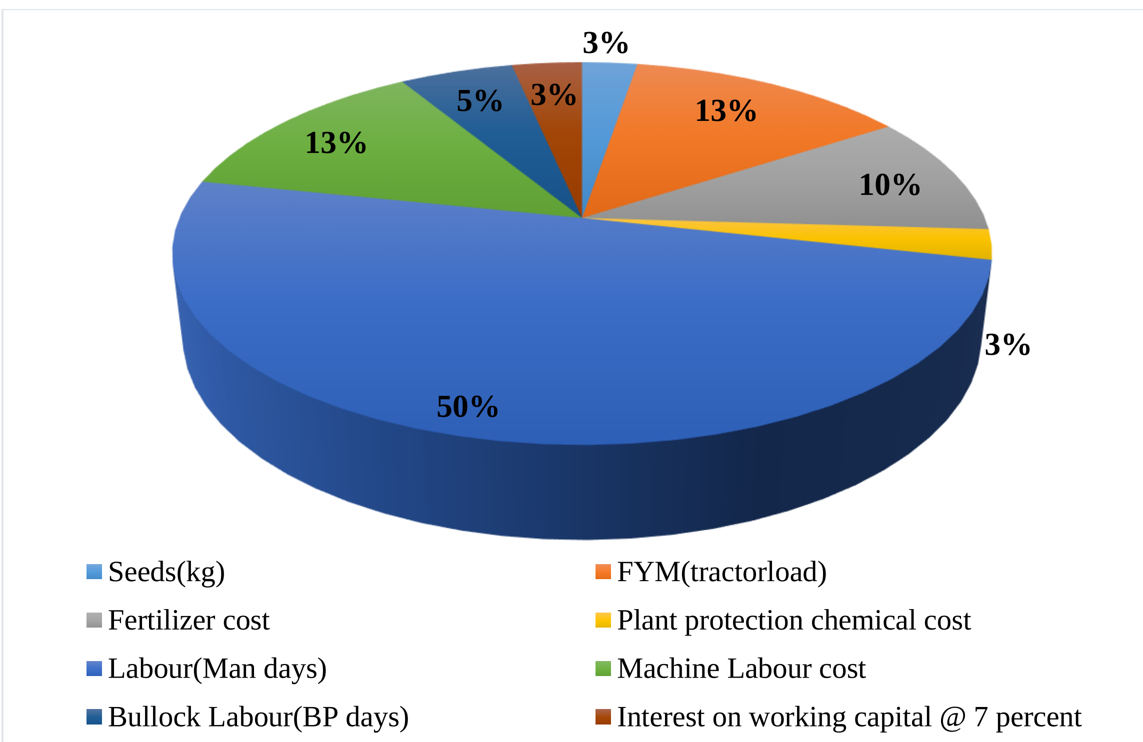

Fig. 4.4 Share of variable cost in BRG-2 redgram seed production

of rejected product by KSSC was 1.7 q and 1.3 q, respectively. The yield of male lines in KBSH-44 and KBSH-53 varieties was 0.8 q and 0.7 q. The gross returns were ₹ 1,90,890 and ₹ 1,78,460 /ha in KBSH-44 and KBSH-53 varieties of sunflower seed production, respectively.

Net return: The net return per hectare from KBSH-44 and KBSH-53 varieties was ₹ 87,941 and ₹ 75,131, respectively. The cost of production was high in KBSH-53 seed production (₹ 7,175 per quintal) compared to that of KBSH-44 (₹ 6,557 /q).

Table 4.15: Cost of cultivation of certified seed production of KBSH-44 variety of sunflower (Per ha)

Sl. No.	Particulars	Qty.	Unit Cost (₹)	Cost (₹)	%
I	**Variable cost**				
	Seeds (kg)				
	Male	1.3	210	273	0.27
	Female	3.8	210	798	0.78
	FYM (tractor load)	5.2	2000	10,400	10.10
	Fertilizer cost (₹)	-	-	8,303	8.07
	Plant protection chemical cost (₹)	-	-	1,613	1.57
	Labour (Man days)	169	300	50,700	49.25
	Machine Labour cost (₹)	-	-	5,680	5.52
	Bullock Labour (BP days)	1.4	710	994	0.97
	Irrigation cost (acre inches)	-	-	4,532	4.40
	Interest on working capital @ 7 %	-	-	2,915	2.83
	Total variable cost			86,208	83.74
II	**Fixed cost**				
	Depreciation	-	-	1,623	1.58
	Land revenue	-	-	35	0.03
	Interest on fixed capital @ 10 %	-	-	83	0.08
	Rental value of land	-	-	15,000	14.57
	Total fixed cost	-	-	16,741	16.26
III	**Total cost of cultivation (I+II)**			**1,02,949**	**100.00**

Table 4.16: Returns from certified seed production of KBSH-44 variety of sunflower

(Per ha)

Returns	Qty.	Unit price (₹)	Value (₹)
Main product			
a) Accepted product(q)	13.2	14,000	1,84,800
b) Rejected product (q)	1.7	2500	4,250
c) Male line seeds (q)	0.8	2300	1,840
Gross returns	-	-	1,90,890
Net returns	-	-	87,941
Cost of production (₹/q)	-	-	6,557
Returns per rupee of quintal	-	-	12,158
Returns per rupee of expenditure	-	-	1.85

Table 4.17: Cost of cultivation of certified seed production of KBSH-53 variety of sunflower

(Per ha)

Sl. No.	Particulars	Qty.	Unit Cost (₹)	Cost (₹)	%
I	**Variable cost**				
	Seeds (kg)				
	Male	1.3	210	269	0.26
	Female	3.9	210	821	0.79
	FYM (tractor load)	4.87	2100	10,227	9.90
	Fertilizer cost (₹)	-	-	7,814	7.56
	Plant protection chemical cost (₹)	-	-	1,400	1.35
	Labour (Man days)	173	300	51,900	50.23
	Machine Labour cost (₹)			5,464	5.29
	Bullock Labour (BP days)	1.65	725	1,196	1.16
	Irrigation cost (acre inches)	-	-	4,491	4.35
	Interest on working capital @ 7 %	-	-	2,925	2.83
	Total variable cost			86,507	83.72
II	**Fixed cost**				
	Depreciation	-	-	1,700	1.65
	Land revenue	-	-	35	0.03
	Interest on fixed capital @ 10 %	-	-	87	0.08
	Rental value of land	-	-	15,000	14.52
	Total fixed cost	-	-	16,822	16.28
III	**Total cost of cultivation (I+II)**			**1,03,329**	**100.00**

Table 4.18: Returns from certified seed production of KBSH-53 variety of sunflower

(Per ha)

Returns	Quantity	Unit price (₹)	Value (₹)
Main product			
a) Accepted product(q)	12.4	14,000	1,73,600
b) Rejected product (q)	1.3	2,500	3,250
c) Male line seeds (q)	0.7	2,300	1,610
Gross returns	-	-	1,78,460
Net returns	-	-	75,131
Cost of production (₹/q)	-	-	7,175
Returns per quintal	-	-	12,393
Returns per rupee of expenditure	-	-	1.73

Returns per rupee of expenditure: The rate of return per rupee of expenditure incurred in sunflower seed production was higher in case of KBSH-44 variety (₹ 1.85) than in KBSH-53 variety (₹ 1.73). Hence, the hypothesis that, there is no difference in return per rupee of expenditure across varieties was rejected.

The results revealed that there is no significant difference in cost of production, between varieties (Table 4.19). Hence, the hypothesis that, there is no difference in cost of seed production across varieties was accepted.

The seed production yielded much higher net returns compared to conventional production (Table 4.19). The labour was the major cost in seed production. The findings of the study are in conformity with that of Kanannavar (2013).

Table 4.19: Comparison between seed production and conventional production on per hectare basis

Sl. No.	Crop	Cost of cultivation	Net returns	Returns per rupee of expenditure	t value
A	**Rice**				
1	IR-64	85,822	68,128	1.80	2.08*
2	Jyothi	88,935	76,572	1.86	
3	a) Conventional	76,239	39,854	1.52	
B	**Red gram**				
1	BRG-1	58,989	33,946	1.58	3.42*
2	BRG-2	51,768	29,122	1.56	
3	b) Conventional	50,860	27,235	1.49	
C	**Sunflower**				
1	KBSH-44	1,02,949	87,941	1.85	1.85
2	KBSH-53	1,03,329	75,131	1.73	
3	c) Conventional	41,451	21,140	1.51	

Source: a) Satishkumar, M, 2017, b) Akshatha, 2017, c) Kanannavar, 2014
Note: *- Significance at 5 per cent

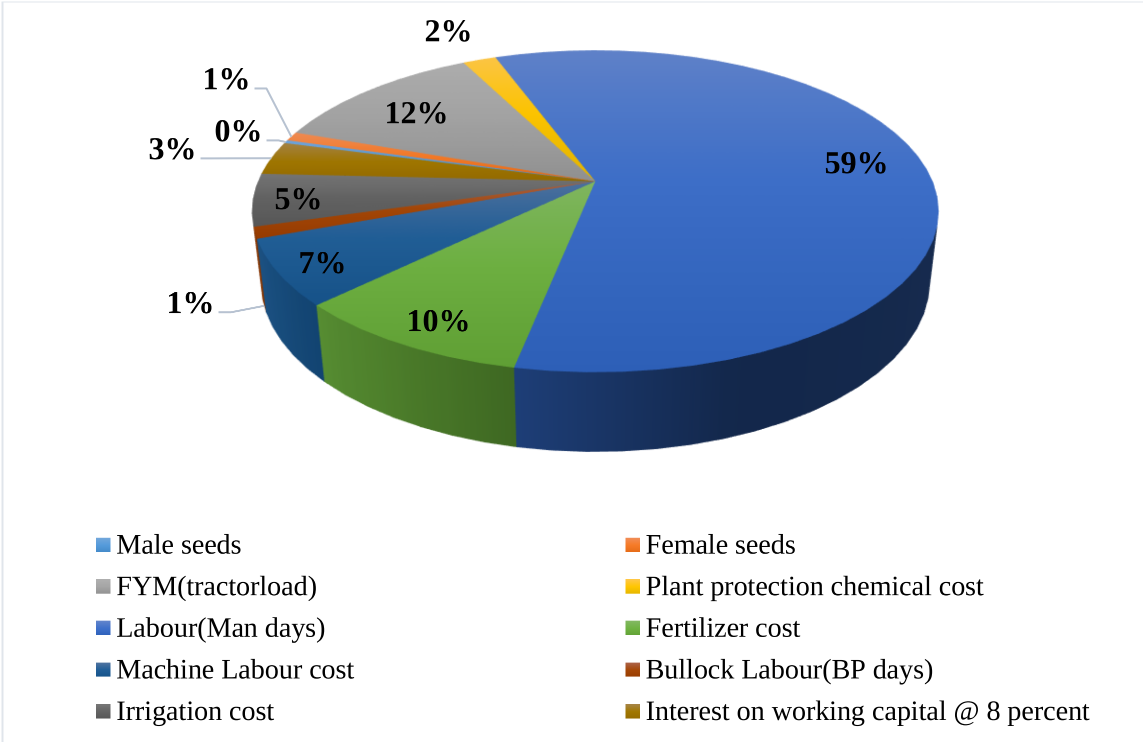

Fig. 4.5 Share of variable cost in KBSH-44 sunflower seed production

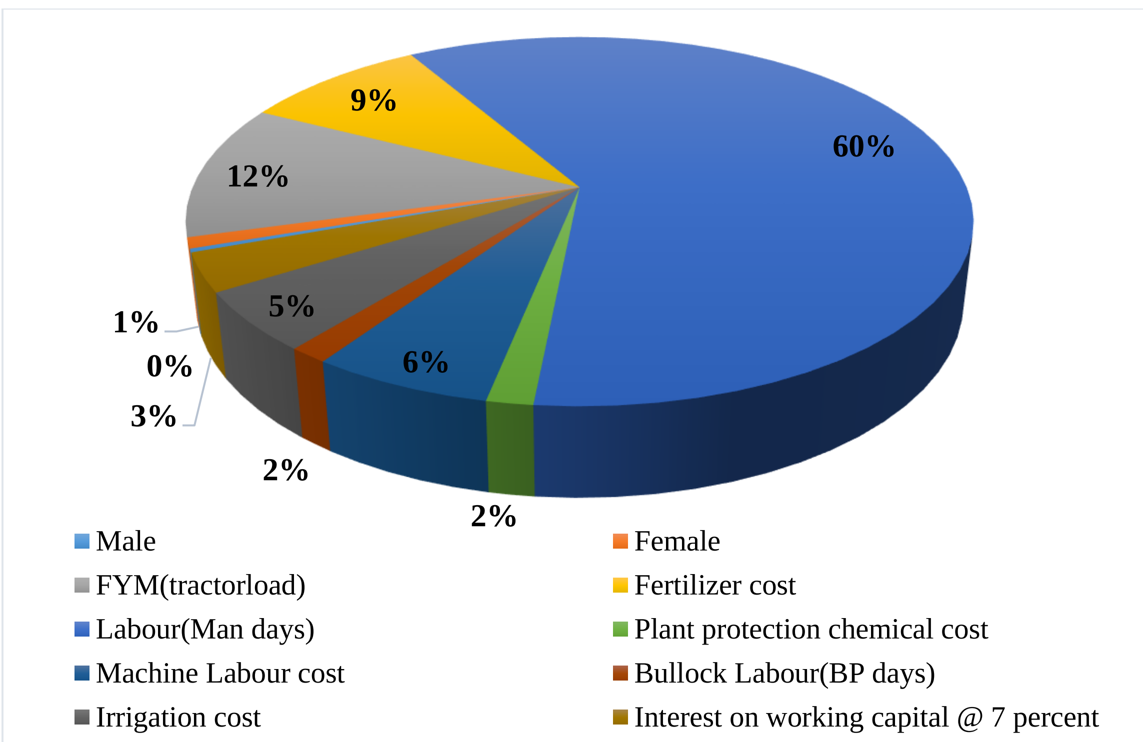

Fig. 4.6 Share of variable cost in KBSH-53 sunflower seed production

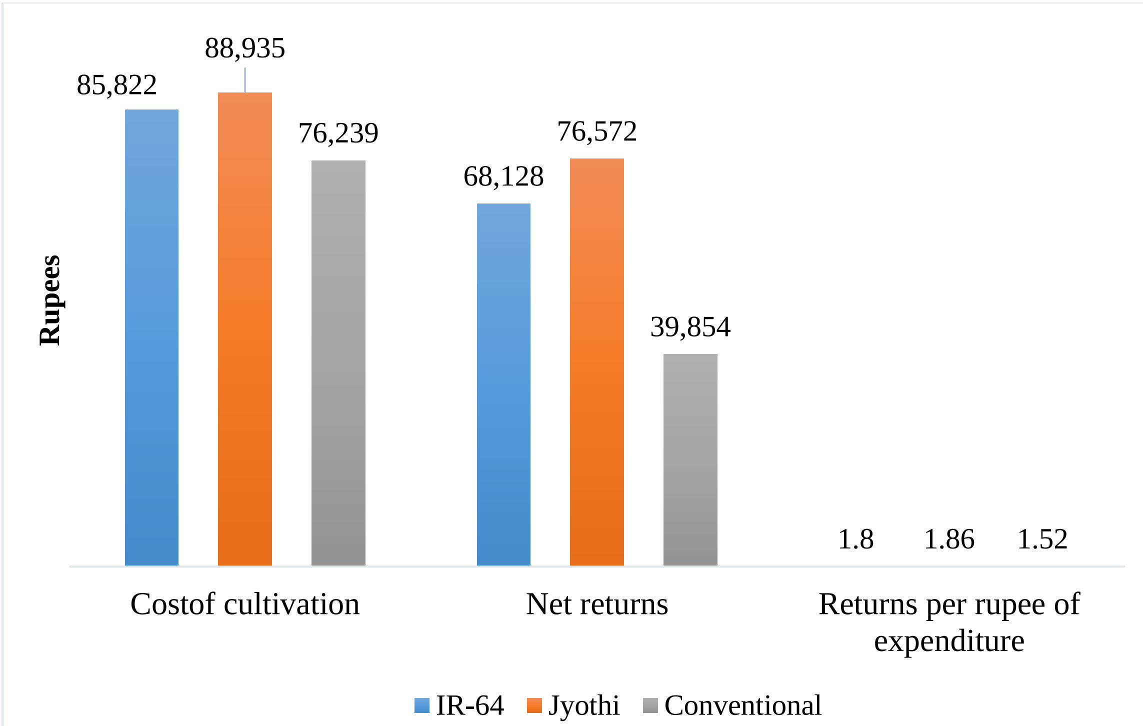

Fig 4.7 Relative economics of seed and grain production in rice

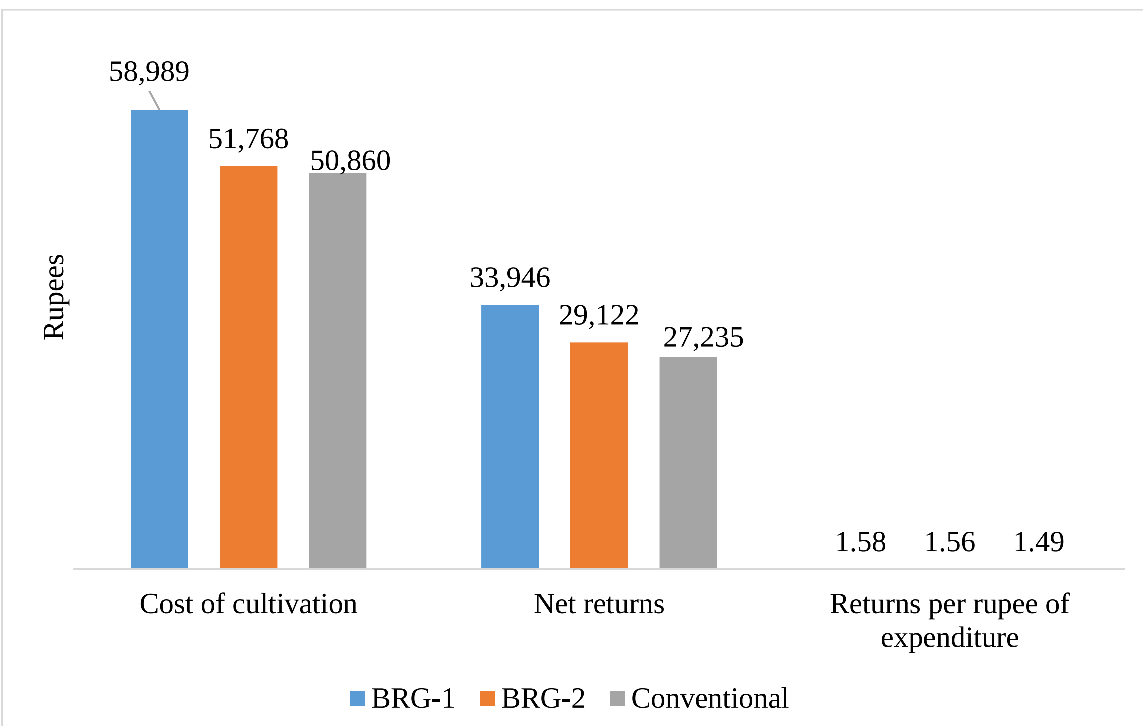

Fig 4.8 Relative economics of seed and grain production in redgram

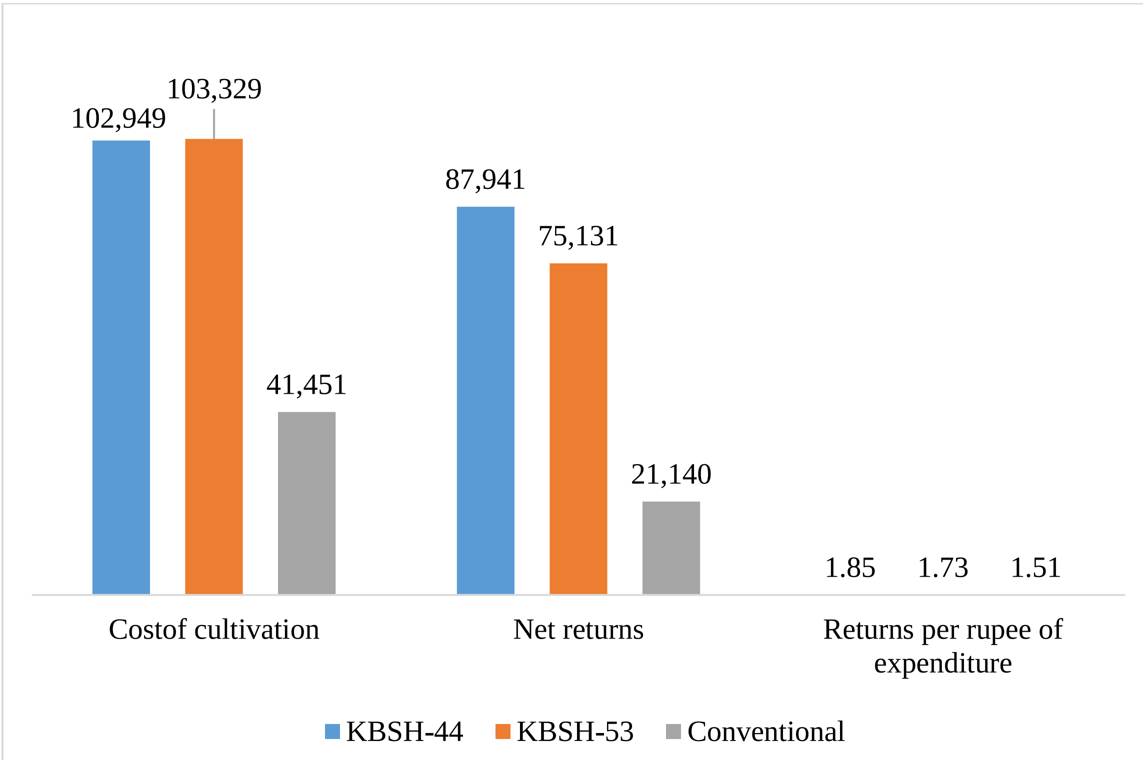

Fig 4.9 Relative economics of seed and grain production in sunflower

4.4 Resource and labour utilization pattern in seed production

4.4.1 Resource use in seed production

Rice seed production: The extent of input use in IR-64 and Jyothi seed production by farmers revealed that, seed rate used in IR-64 and Jyothi varieties was 65.77 kg per ha and 73.6 kg per ha, which was higher than the recommended level. The difference in seed rate between varieties was not significant. The FYM applied was ₹ 9,149 in IR-64 and ₹ 6,308 Jyothi variety and this was found to be statistically significant at one per cent. The expenditure on fertilizer was higher in Jyothi variety (₹ 6,153) compared to IR-64 variety (₹ 5,371) which was significant. The use of human labour was higher in IR-64 variety (88 man days) when compared to Jyothi variety (68 man days) which was non-significant. On machine labour the amount spent per hectare was ₹ 16,179 and ₹ 22,038 in IR-64 and Jyothi varieties, respectively which was significant. The bullock pair days employed per hectare under IR-64 (1.24) and Jyothi (0.2) variety seed production was significant.

Redgram seed production: The extent of input use in BRG-1 and BRG-2 seed production by farmers revealed that, on an average 2.9 and 2.1 tractor load of FYM was used which was statistically significant. The cost of fertilizers applied in BRG-1(₹ 4,123) and in BRG-2(₹ 3,601) variety was non-significant. The difference in cost of plant protection chemical cost, machine labour cost, seeds and bullock labour costs were significant. (Table 4.21).

Sunflower seed production: The average cost incurred for fertilizer in KBSH-44 (₹ 7,814) and KBSH-53 (₹ 8,303) was significant. The average cost of plant protection chemical was high in KBSH-44 (₹ 1,613) compared to KBSH-53 (₹ 1,400) and was significant. The difference among human labour, machine labour and bullock labour were significant whereas difference of cost in seeds and FYM were found to be non-significant. (Table 4.22).

4.4.2 Labour utilization pattern in seed production

The details regarding total labour employed in seed production is given in Table 4.23. In case of rice seed production, majority of labour is utilised for nursery making and transplanting in both the varieties, followed by harvesting and threshing (26 %) in IR-64 variety and weeding and roughing (24 %) in case of Jyothi variety.

In case of redgram, majority of labour was utilised for harvesting and threshing operation in BRG-1 variety and weeding and roughing operation in BRG-2 variety. The next operation which utilised major labour was sowing followed by other operations like cleaning, drying and bagging.

The labour utilization pattern of KBSH-44 and KBSH-53 varieties of sunflower given in Table 4.23 showed that, the major labour utilising operation in sunflower seed production was pollination which included on an average of 60 and 63 man-days in KBSH-44 and KBSH-53 variety, respectively. Harvesting and threshing operation was the next labour-intensive operation in both the varieties.

Table 4.20: Resource - use pattern in IR-64 and Jyothi varieties of rice seed production (Per ha)

Sl. No.	Particulars	IR-64		Jyothi		t value
		Qty.	Value (₹)	Qty.	Value (₹)	
1	Seeds (kg) @	65.77	2,170	73.6	3,797	-0.30 NS
2	FYM (tractor load)	4.21	9,149	2.9	6,308	-2.9**
3	Fertilizer cost	-	5,371	-	6,153	7.2**
4	Plant protection chemical cost	-	995	-	4,625	-12.3*
5	Human labour (Man days)	88	26,426	68	22,236	1.5 NS
6	Machine labour (₹)	-	16,179	-	22,038	3**
7	Bullock labour (BP days)	1.24	771	0.2	132	2.9**

Note: @ Recommended seed rate per hectare is 62.5
*- Significance at 5 per cent
**- Significance at 1 per cent

Table 4.21: Resource - use pattern in BRG-1 and BRG-2 varieties of red gram seed production (Per ha)

Sl. No.	Particulars	BRG-1		BRG-2		t value (value)
		Qty.	Value (₹)	Qty.	Value (₹)	
1	Seeds (kg)	12.8	935	12.7	924	-1.12 NS
2	FYM (tractor load)	2.9	6,699	2.1	4,704	3.02**
3	Fertilizer cost	-	4,123	-	3,601	-0.07 NS
4	Plant protection chemical cost	-	852	-	903	0.64 NS
5	Human labour (Man days)	64	19,200	59	17,700	3.57**
6	Machine labour (₹)	-	7,426	-	4,646	-1.20 NS
7	Bullock labour (BP days)	2.12	1,993	2.14	1,905	1.03 NS

Note: *- Significance at 5 per cent.
**- Significance at 1 per cent

Table 4.22: Resource - use pattern in KBSH-44 and KBSH-53 varieties of sunflower seed production (Per ha)

Sl. No.	Particulars	KBSH-44		KBSH-53		t value (value)
		Qty.	Value (₹)	Qty.	Value (₹)	
1	Seeds (kg)					
	Male	1.3	273	1.3	269	-1.40 NS
	Female	3.8	798	3.9	821	-1.38 NS
2	FYM (tractor load)	5.3	10,400	4.87	10,227	-1.06 NS
3	Fertilizer cost	-	8,303	-	7,814	7.2*
4	Plant protection chemical cost	-	1,613	-	1,400	-12.3**
5	Human labour (Man days)	169	50,700	173	51,900	-6.18*
6	Machine labour (₹)	-	5,680	-	5,464	4.59*
7	Bullock labour (BP days)	1.4	994	1.65	1,196	3.59**

Note: *- Significance at 5 per cent
**- Significance at 1 per cent

Table 4.23: Labour utilization pattern in seed production **(man days)**

Sl. No.	Particulars	IR-64	Jyothi	BRG-1	BRG-2	KBSH-44	KBSH-53
1	Nursery/Sowing/ Transplanting	26 (29.55)	22 (28.95)	12 (18.75)	13 (22.03)	18 (10.65)	19 (10.98)
2	Manure and fertilizer application	7 (7.95)	7 (9.21)	6 (9.38)	5 (8.47)	10 (5.92)	14 (8.09)
3	Weeding and Roughing	18 (20.45)	16 (23.53)	17 (26.56)	16 (27.12)	32 (18.93)	30 (17.34)
4	Pollination	-	-	-	-	60 (35.50)	63 (36.42)
5	Harvesting and threshing	23 (26.14)	12 (17.65)	18 (28.13)	15 (25.42)	27 (15.98)	27 (15.61)
6	Others (cleaning /drying/bagging)	14 (15.91)	11 (16.18)	11 (17.19)	10 (16.95)	22 (13.02)	20 (11.56)
	Total	88 (100)	68 (100)	64 (100)	59 (100)	169 (100)	173 (100)

Note: Figures in parentheses are in percentage

4.5 Resource-use efficiency in seed production

4.5.1 Cobb-Douglas production function estimates in rice seed production

The Cobb-Douglas type of production function as specified in the methodology chapter was used to identify the factors influencing rice, red gram and sunflower seed production. The Cobb-Douglas production function was estimated by using Ordinary Least Squares (OLS) technique and the regression coefficients represent individual elasticity of production. It is to state that, if the value of elasticity of production is less than one meaning, a unit increase in the input would result in less than a unit increase in the gross returns.

The co-efficient of multiple determination (R^2) was 0.79 and 0.92 for IR-64 variety and Jyothi variety, respectively, indicating that the independent variables included in the production function explained 79 per cent and 92 per cent of the variation in the production of IR-64 and Jyothi varieties of rice seed production (Table 4.24).

In case of IR-64 variety regression co-efficient of fertilizers, human labour and area were 0.021, 0.025 and 0.885, respectively which were found to be statistically significant. The regression co-efficient of other variables, seeds (-0.003), FYM (0.005), Plant protection chemical (0.023) and machine labour were found to be statistically non-significant. One unit increase in the input use of fertilizer, human labour and area above its geometric mean level will lead to 0.021, 0.025 and 0.885 increase in gross returns (₹) from its geometric mean level. The overall regression model was found to be significant at one per cent.

Table 4.24: Estimates of Cobb-Douglas production function in IR-64 and Jyothi varieties of rice certified seed production

[Dependent variable (Y): Gross returns in rupees per farm]

Variables	Parameters	IR	Jyothi
Intercept	a	12434.34** (5.69)	377.37** (5.06)
Seeds cost (X_1)	b_1	-0.003^NS^ (-1.99)	0.012 ^NS^ (1.94)
FYM cost (X_2)	b_2	0.0005 ^NS^ (0.02)	0.045 ^NS^ (1.48)
Fertilizer cost (X_3)	b_3	0.021** (6.07)	0.007 ^NS^ (0.16)
Plant protection chemical cost (X_4)	b_4	0.023 ^NS^ (0.98)	0.02* (2.05)
Human labour cost (X_5)	b_5	0.025* (2.25)	0.115 ^NS^ (1.60)
Machine Labour cost (X_6)	b_6	0.014 ^NS^ (0.31)	0.014 ^NS^ (0.41)
Area in acre (X_7)	b_7	0.885** (4.52)	0.50** (4.68)
Co-efficient of multiple determination	R^2	0.79	0.92
F value		1.41**	8.4**

Note: 1. *- Significant at 5 per cent
2. * *- Significant at 1 per cent
3. Figures in parentheses represents ‘t’ value

In case of Jyothi variety regression coefficient of plant protection chemical (0.02) and area (0.50) were found to be statistically significant at five and one per cent, respectively. Whereas the regression co-efficient of seeds (0.012), FYM (0.045), human labour (0.115) and machine labour (0.014) were found to be statistically non-significant. If the significant variables, seed and area were increase by one unit above its geometric mean level, the gross returns (₹) will increases by 0.012 and 0.50 from its geometric mean level. The overall regression model was found to be significant at one per cent.

4.5.2 Cobb-Douglas production function estimates in red gram seed production

The co-efficient of multiple determination (R^2) was 0.94 and 0.91 for BRG-1 variety and BRG-2 variety, respectively, indicating that the independent variables included in the production function explained 94 per cent and 91 per cent of the variation in the production of BRG-1 and BRG-2 varieties of redgram seed production (Table 4.25).

In case of BRG-1 variety regression co-efficient of FYM (0.020), human labour (0.0008) and area (0.546) were statistically significant at one per cent. The regression co-efficient of other variables seeds (-0.054), fertilizer (0.046) and machine labour (0.008) were statistically non-significant. One unit increase in the input use of FYM, human labour and area above its geometric mean level will lead to 0.020, 0.0008 and 0.546 increase in gross returns (₹) from its geometric mean level, respectively. The overall regression model was found to be significant at one per cent.

In case of BRG-2 variety regression coefficient of fertilizer (0.05), human labour (0.410) and area (0.63) were statistically significant at one per cent. Whereas the regression co-efficient of seeds (-0.280), FYM (0.025), plant protection chemical (0.026) and machine labour (0.104) were statistically non-significant. If the significant variables fertilizer, human labour and area were increase by one unit above its geometric mean level, the gross returns (₹) will increases by 0.05, 0.410 and 0.63 from its geometric mean level. The overall regression model was found significant at one per cent.

Table 4.25: Estimates of Cobb-Douglas production function in BRG -1 and BRG -2 varieties of red gram certified seed production

[Dependent variable (Y): Gross returns in rupees per farm]

Variables	Parameters	BRG -1	BRG -2
Intercept	a	275.68** (4.65)	339.75** (4.01)
Seeds cost (X_1)	b_1	-0.054 NS (-1.70)	-0.280 NS (-1.71)
FYM cost (X_2)	b_2	0.020** (3.02)	0.025 NS (1.09)
Fertilizer cost (X_3)	b_3	0.046 NS (1.84)	0.05** (2.83)
Plant protection chemical cost (X_4)	b_4	0.0008 NS (0.24)	0.026 NS (0.84)
Human labour cost (X_5)	b_5	0.211** (3.21)	0.410** (3.99)
Machine Labour cost (X_6)	b_6	0.008 NS (0.27)	0.104 NS (1.77)
Area in acre (X_7)	b_7	0.546** (3.59)	0.633** (3.46)
Co-efficient of multiple determination	R^2	0.94	0.91
F value		1.52**	3.21866E-10**

Note: 1. *- Significant at 5 per cent
2. * *- Significant at 1 per cent
3. Figures in parentheses represents 't' value

4.5.3 Cobb-Douglas production function estimates in sunflower seed production

The co-efficient of multiple determination (R^2) was 0.86 and 0.85 for KBSH-44 variety and KBSH-53 variety, respectively, indicating that the independent variables included in the production function explained 94 per cent and 91 per cent of the variation in the production of KBSH-44 and KBSH-53 varieties of sunflower seed production (Table 4.26).

In case of KBSH-44 variety regression co-efficient of seeds (0.001), plant protection (0.019) were statistically significant at one per cent and human labour (0.296) was statistically significant at five per cent. The regression co-efficient of other variables FYM (0.093), fertilizer (0.023) and machine labour (0.057) were statistically non-significant. One unit increase in the input use of seeds, plant protection chemicals and human labour above its geometric mean level will lead to 0.001, 0.019 and 0.296 increase in gross returns (₹) from its geometric mean level. The overall regression model was found significant at one per cent.

Table 4.26: Estimates of Cobb-Douglas production function in KBSH-44 and KBSH-53 varieties of sunflower certified seed production

[Dependent variable (Y): Gross returns in rupees per farm]

Variables	Parameters	KBSH-44	KBSH-53
Intercept	a	313.2** (3.81)	5074** (14.05)
Seeds cost (X_1)	b_1	0.001** (5.00)	0.021 ^{NS} (0.85)
FYM cost (X_2)	b_2	0.093 ^{NS} (0.53)	0.062 ^{NS} (0.36)
Fertilizer cost (X_3)	b_3	0.023 ^{NS} (1.34)	0.023* (2.87)
Plant protection chemical cost (X_4)	b_4	0.019** (2.44)	0.004 ^{NS} (1.41)
Human labour cost (X_5)	b_5	0.296* (4.97)	0.251 ^{NS} (1.33)
Machine Labour cost (X_6)	b_6	0.057 ^{NS} (0.73)	0.120 ^{NS} (1.37)
Area in acre (X_7)	b_7	0.022 ^{NS} (0.10)	0.360** (2.03)
Co-efficient of multiple determination	R^2	0.86	0.85
F value		3.03**	1.8**

Note: 1. *- Significant at 5 per cent
2. * *- Significant at 1 per cent
3. Figures in parentheses represents 't' value

In case of KBSH-53 variety regression coefficient of fertilizer (0.023) was significant at five per cent and area (0.360) was statistically significant at one per cent. Whereas the regression co-efficient of seeds (0.021), FYM (0.062), plant protection chemical (0.004), human labour (0.251) and machine labour (0.120) were statistically non-significant. If the significant variables fertilizer and area were increased by one unit above its geometric mean level, the gross returns (₹) will increases by 0.023 and 0.360 from its geometric mean level. The overall regression model was found significant at one per cent.

4.5.4 Allocative efficiency

Allocative (or price) efficiency refers to the ability of the firm to combine inputs and outputs in optimal proportions in the light of prevailing prices and is measured in terms of behavioural goal of the production unit like observed vs optimum cost or observed profit vs optimum profit. The allocative efficiency was estimated by using the geometric mean levels of the output as well as input.

Rice seed production

In case of IR-64, the ratio of MVP to MFC for fertilizers and human labour was less than one indicating there was no scope for using additional units of these inputs. The ratio of MVP to MFC for area was 1.65, indicating for every additional rupee spent on this input would give the return of ₹ 1.65 (Table 4.27). In case of Jyothi the ratio of MVP to MFC for plant protection chemicals and area were 0.96 and 1.10. As the ratio of area is more than one still there is scope to increase the area under production (Table 28).

Redgram seed production

In BRG-1 variety, the ratio of MVP to MFC in case of FYM, human labour and area were 0.44, 1.06 and 0.54, indicating that the FYM and area were over utilised and human labour is underutilised, hence there is still scope to increase the human labour in production to get more returns (Table 29). One unit increase in the input of human labour would above its geometric mean level will lead to 0.44 increase in gross returns (₹) from its geometric mean level.

Table 4.27: Resource - use efficiency in IR-64 rice certified seed production

(per farm)

Variables	Input use at geometric mean level (₹)	Co-efficient	MVP	MFC	MVP/ MFC
Seeds cost	5,831	-0.003 NS	-0.891	1	-0.18
FYM cost	15,189	0.0005 NS	0.012	1	0.01
Fertilizer cost	9,717	0.021*	0.711	1	0.71
Plant protection chemical cost	1,563	0.023 NS	5.192	1	5.19
Human labour cost	37,251	0.025**	0.241	1	0.24
Machine Labour cost	28,768	0.014 NS	0.169	1	0.16
Area (acres)	4.6	0.885*	66,085	40,000	1.65

Note: 1. *- Significant at 5 per cent
2. * *- Significant at 1 per cent

Table 4.28: Resource - use efficiency in Jyothi rice certified seed production

(per farm)

Variables	Input use at Geometric mean level (₹)	Co-efficient	MVP	MFC	MVP/ MFC
Seeds cost	6,702	0.012 NS	0.974	1	0.97
FYM cost	8,944	0.045 NS	0.034	1	2.75
Fertilizer cost	13,815	0.007 NS	0.005	1	0.29
Plant protection chemical cost	11,261	0.020**	0.966	1	0.96
Human labour cost	38,933	0.115 NS	1.611	1	1.61
Machine Labour cost	37,820	0.014 NS	0.214	1	0.21
Area (acres)	5.5	0.506*	44,220	40,000	1.10

Note: 1. *- Significant at 5 per cent
2. * *- Significant at 1 per cent

Table 4.29: Resource - use efficiency in BRG-1 red gram certified seed production (per farm)

Variables	Input use at geometric mean level (₹)	Co-efficient	MVP	MFC	MVP/ MFC
Seeds cost	1,019	-0.054 NS	-4.8	1	-4.8
FYM cost	4,150	0.020**	0.44	1	0.44
Fertilizer cost	3,274	0.046 NS	1.29	1	1.29
Plant protection chemical cost	852	0.0008 NS	0.08	1	0.08
Human labour cost	18,095	0.211**	1.06	1	1.06
Machine Labour cost	7,492	0.008 NS	0.09	1	0.09
Area (acres)	3	0.541**	16,290	30,000	0.54

Note: 1. **- Significant at 1 per cent

In case of BRG-2 variety, the ratio of MVP to MFC of fertilizer and human labour were 1.49 and 1.58, respectively indicating on invest of one rupee on fertilizer and human labour would give additional gross returns of ₹ 1.49 and ₹ 1.58 (Table 30).

Table 4.30: Resource - use efficiency in BRG-2 red gram certified seed production (per farm)

Variables	Input use at geometric mean level (₹)	Co-efficient	MVP	MFC	MVP/ MFC
Seeds cost	1,149	0.280 NS	12.89	1	12.89
FYM cost	1,664	0.0252 NS	0.80	1	0.80
Fertilizer cost	1,786	0.050**	1.49	1	1.49
Plant protection chemical cost	391	0.026 NS	3.59	1	3.59
Human labour cost	13,620	0.410**	1.58	1	1.58
Machine Labour cost	4,358	0.104 NS	1.26	1	1.26
Area (acres)	3	0.633**	11,136	30,000	0.27

Note: 1.**- Significant at 5 per cent

Sunflower seed production

In KBSH-44 variety, the ratio of MVP to MFC for seeds was 0.24 which implied that the seeds are over utilised and the ratio of plant protection chemicals (1.55) and human labour (1.86) indicated that for every additional rupee spent on these inputs would give returns of ₹ 1.55 and ₹ 1.86, respectively (Table 4.31).

In case of KBSH-53, the ratio of fertilizer was 0.66 indicating the over utilization whereas the ratio of area was 1.02 indicating scope to increase the input.

Table 4.31: Resource - use efficiency in KBSH-44 sunflower certified seed production (per farm)

Variables	Input use at geometric mean level (₹)	Co-efficient	MVP	MFC	MVP/ MFC
Seeds cost	758	0.001**	0.24	1	0.24
FYM cost	9,418	0.093 NS	1.84	1	1.84
Fertilizer cost	6,431	0.023 NS	0.58	1	0.58
Plant protection chemical cost	1,205	0.01**	1.55	1	1.55
Human labour cost	30,454	0.296*	1.81	1	1.81
Machine Labour cost	7,800	0.057 NS	1.36	1	1.36
Area (acres)	3	0.022 NS	1368	25,000	0.05

Note: 1. *- Significant at 5 per cent
2. **- Significant at 1 per cent

Table 4.32: Resource - use efficiency in KBSH-53 sunflower certified seed production (per farm)

Variables	Input use at geometric mean level (₹)	Co-efficient	MVP	MFC	MVP/ MFC
Seeds cost	877	0.021 NS	4.47	1	4.47
FYM cost	10,138	0.06 NS	1.21	1	1.21
Fertilizer cost	6,430	0.023*	0.66	1	0.66
Plant protection chemical cost	1,498	0.004 NS	0.49	1	0.49
Human labour cost	30,937	0.251 NS	1.51	1	1.51
Machine Labour cost	8,598	0.120 NS	2.60	1	2.60
Area (acres)	2.6	0.360**	25,655	25,000	1.02

Note: 1. *- Significant at 5 per cent
2. * *- Significant at 1 per cent

Technical Allocative and Economic efficiency of the farms

Technical efficiency levels of each of the farms were estimated by Data Envelop Analysis (DEA) separately for rice, redgram and sunflower seed production using the linear programming technique. The criterion used by Ferreira (2005) was adopted in the present study to decide the cut-off score for efficient farms. Farms which had a score of 0.90 and above were considered as efficient farms.

Rice seed production: The results of technical efficiency in Table 4.33, it is seen that average technical efficiency, allocative efficiency and cost efficiency were more in Jyothi varietal seed producing farms (0.92, 0.92 and 0.84, respectively) compared to IR-64 varietal seed producing farms (0.90, 0.91 and 0.83, respectively).

Table 4.33: Technical, Allocative and Cost Efficiency of certified rice seed producing farms of IR-64 and Jyothi varieties

Variety	**IR-64**			**Jyothi**		
Efficiency	TE	AE	CE	TE	AE	CE
0.5-0.6	0 (0)	0 (0)	2 (6.67)	0 (0)	0 (0)	0 (0)
0.6-0.7	0 (0)	4 (13.33)	3 (10.00)	2 (6.67)	0 (0)	4 (13.33)
0.7-0.8	1 (3.33)	11 (36.67)	10 (33.33)	4 (13.33)	3 (10.00)	6 (20.00)
0.8-0.9	1 (3.33)	5 (16.67)	7 (23.33)	5 (16.67)	3 (10.00)	11 (36.67)
0.9-1	28 (93.33)	10 (33.33)	8 (26.67)	19 (63.33)	24 (80.00)	9 (30.00)
Total	30 (100)	30 (100)	30 (100)	30 (100)	30 (100)	30 (100)
Average	0.90	0.91	0.83	0.92	0.92	0.845

Note: Figures in Parenthesis are per centage to total number of farmers
TE: Technical Efficiency
AE: Allocative Efficiency
CE: Cost / Economic Efficiency
Inputs Considered are seeds, human labour, bullock labour, FYM

It is observed that only a small proportion of the farms were economically efficient (>0.90) in both IR-64 (26.67 %) and Jyothi (30.00 %) varieties of rice seed production. Most of the farms were lying in the score ranging between 0.7 to 0.8 in IR-64variety (33 %) and in case of Jyothi most of the farms were lying in the score ranging between 0.8 to 0.9 (36.67 %).

Redgram seed production: The results of technical efficiency in Table 4.34, it is observed that average technical efficiency, allocative efficiency and cost efficiency were more in BRG-1 (0.98, 0.93 and 0.91, respectively) compared to BRG-2 (0.81, 0.70 and 0.56, respectively).

Table 4.34: Technical, Allocative and Cost Efficiency of certified red gram seed producing farms of BRG-1 and BRG-2 varieties

Variety	BRG-1			BRG-2		
Efficiency	**TE**	**AE**	**CE**	**TE**	**AE**	**CE**
0.2-0.3	0 (0)	0 (0)	0 (0)	0 (0)	2 (6.66)	2 (6.66)
0.3-0.4	0 (0)	0 (0)	0 (0)	0 (0)	1 (3.33)	2 (6.66)
0.4-0.5	0 (0)	0 (0)	0 (0)	0 (0)	2 (6.66)	7 (23.33)
0.5-0.6	0 (0)	0 (0)	1 (3.33)	5 (16.67)	2 (6.66)	8 (26.66)
0.6-0.7	3 (10.00)	0 (0)	3 (10.00)	3 (10.00)	5 (16.66)	5 (16.66)
0.7-0.8	3 (10.00)	3 (10.00)	7 (23.33)	7 (23.33)	5 (16.66)	0 (0)
0.8-0.9	2 (6.66)	3 (10.00)	6 (20.00)	3 (10.00)	8 (26.66)	2 (6.66)
0.9-1	22 (73.33)	24 (80.00)	13 (43.33)	12 (40.00)	5 (16.66)	4 (13.33)
Total	30 (100)	30 (100)	30 (100)	30 (100)	30 (100)	30 (100)
Average	0.98	0.93	0.91	0.81	0.70	0.56

Note: Figures in Parenthesis are percentage to total number of farmers.
TE: Technical Efficiency
AE: Allocative Efficiency
CE: Cost / Economic Efficiency
Inputs Considered are seeds, human labour, bullock labour, FYM

It is observed from the Table 4.34, that farms growing BRG-1varity were efficient in all the three efficiencies, farms growing BRG-2 showed less efficiencies, hence there is scope to reallocate the resources in seed producing BRG-2 varietal seed production.

Sunflower seed production: The results of technical efficiency are presented in Table 4.35. It can be seen that average technical efficiency, allocative efficiency and cost efficiency of KBSH-44 varietal seed producing farms were 0.83, 0.81 and 0.79, respectively. And in case of KBSH-53 varietal seed production technical efficiency, allocative efficiency and technical efficiencies of farms were 0.73, 0.50 and 0.39, respectively).

Table 4.35: Technical, Allocative and Cost Efficiency of certified sunflower seed producing farms of KBSH-44 and KBSH-53 varieties

Variety	KBSH-44			KBSH-53		
Efficiency	**TE**	**AE**	**CE**	**TE**	**AE**	**CE**
0.5-0.6	1 (3.33)	3 (10.00)	4 (13.33)	1 (3.33)	3 (10.00)	5 (16.67)
0.6-0.7	7 (23.33)	5 (16.67)	5 (16.67)	2 (6.67)	3 (10.00)	5 (16.67)
0.7-0.8	8 (26.67)	6 (20.00)	2 (6.67)	8 (26.67)	5 (16.67)	6 (20.00)
0.8-0.9	5 (16.67)	6 (20.00)	12 (40.00)	11 (36.67)	10 (33.33)	4 (13.33)
0.9-1	9 (30.00)	10 (33.33)	7 (23.33)	8 (26.67)	9 (30.00)	10 (33.33)
Total	30 (100)	30 (100)	30 (100)	30 (100)	30 (100)	30 (100)
Average	0.83	0.81	0.79	0.83	0.80	0.78

Note: Figures in Parenthesis are percentage to total number of farmers
TE: Technical Efficiency
AE: Allocative Efficiency
CE: Cost / Economic Efficiency
Inputs Considered are seeds, human labour, bullock labour, FYM

4.6 Requirement availability gap of quality seeds

From the Table 4.36 it is evident that the gap of certified and quality seeds is increasing from years. In the period 2011-12, only in case of potato crop the requirement was not met (42.14 %). In 2012-13, there was gap of 1.39 per cent, 19.89 per cent and 19.18 per cent in case of pulses, potato and fodder crops. Recently in 2015-16-year majority showed certain portion of gap namely, pulses (10.66 %), oilseeds (13.56 %), Jute/Mesta (3.90 %) and potato (8.87 %).

As per the Table 4.37 it is evident that there has been a shortage of certified seeds and quality seeds (including all the varieties) over the years in paddy crop of our state. In Kharif season of 2015-16, the gap was 19.61 per cent which was found to be increased to 55.95 per cent in rabi season. In Kharif season of 2016-17, the gap was 29.28 per cent which increased to 78.44 per cent in rabi season. Hence, the hypothesis that in rice and redgram quality seeds demand supply gap is more than 10 percent is accepted.

The gap of certified and quality seeds in case of redgram including all the varieties was 52.24 per cent and 21.40 per cent in 2015-16 and 2016-17 periods, respectively.

The gap of sunflower certified and quality seeds found to be more in all the four periods, kharif season of 2015-16 (59.43 %), rabi season (51.70 %) and in 2016-17 it was 43.60 per cent in kharif and 52.47 per cent in rabi season. Hence the hypothesis that, in case of sunflower certified and quality seeds demand supply gap is more than 30 per cent is accepted.

The leading varieties of rice and the study was taken on IR-64 and Jyothi varieties, whose demand supply gap analysis shown in Table 4.40, indicated that in IR-64 variety the gap was negative in all the four seasons, during rabi season of 2016-17 the gap was highest (85 %), where as in Jyothi the availability was more than demand in kharif seasons of 2015-16 (26 %) and 2016-17 (9 %). Due to the incidence of pests to Jyothi in the immediate past season the farmers shifted to other varieties of paddy, hence there was no gap.

In case of BRG-1 variety of redgram, the gap was 23 per cent in 2015 which decreased to 11 per cent in 2016 year. In BRG-2 variety the gap was much higher compared to BRG-1 in 2015 (31 %) and in 2016 the excess of 28 per cent was noticed as the farmers shifted to other varieties as it resulted in less yield (Table 4.41).

The leading varieties of sunflower KBSH-44 and KBSH-53 demand supply gap analysis shown in Table 4.42 indicated that, the gap in both the varieties over the years is much higher (above 70 %) except in kharif season of 2016-17 (33 %) (Table 4.42).

Table 4.36: Crop-wise Requirement (Demand) and Availability (Supply) of Certified/Quality seed in India (2011-2012 to 2015-2016)

(Qty. in lakh quintal)

Crops	2011-2012			2012-2013			2013-2014			2014-2015			2015-16		
	A	**R**	**Gap**	**A**	**R**	**Gap**	**A**	**R**	**Gap**	**A**	**R**	**Gap**	**A**	**R**	**Gap**
Cereals	231.20	209.01	22.19 (10.62)	212.79	204.50	8.29 (4.05)	219.18	213.07	6.11 (2.87)	230.74	215.58	15.16 (7.03)	235.53	215.15	20.38 (9.4)
Pulses	28.54	24.73	3.81 (15.41)	26.28	26.65	-0.37 (-1.39)	32.90	28.08	4.82 (17.17)	28.87	28.88	-0.01 (-0.0)	27.24	30.49	-3.25 (10.6)
Oilseeds	72.84	63.42	9.42 (14.85)	68.51	58.92	9.59 (16.28)	71.73	66.88	4.85 (7.25)	61.93	67.13	-5.20 (-7.7)	51.39	59.45	-8.06 (-13.0)
Cotton	2.67	2.35	0.32 (13.62)	2.72	2.41	0.31 (12.86)	2.46	2.21	0.25 (11.31)	2.63	2.22	0.41 (18.47)	2.08	1.95	0.13 (6.67)
Jute	0.48	0.40	0.08 (20.00)	0.37	0.36	0.01 (2.78)	0.39	0.53	-0.14 (-0.61)	0.61	0.45	0.16 (35.5)	0.14	0.36	-0.22 (-61.1)
Fibre	3.15	2.75	0.40 (14.55)	3.09	2.77	0.32 (11.55)	2.86	2.74	0.12 (4.38)	3.24	2.68	0.56 (20.9)	2.22	2.31	-0.09 (-3.9)
Potato	17.34	29.97	-12.63 (-42.14)	17.32	21.62	-4.30 (-19.89)	18.95	22.91	-3.96 (-17.2)	24.85	27.19	-2.34 (-8.6)	26.10	28.64	-2.54 (-8.8)
Other	0.56	0.54	0.02 (3.70)	0.59	0.73	-0.14 (-19.18)	1.70	1.59	0.11 (6.92)	2.14	2.09	0.05 (2.3)	1.05	1.05	0.00 (0.0)
Grand Total	**353.62**	**330.41**	**23.21**	**328.58**	**315.19**	**13.39**	**347.31**	**335.26**	**12.05**	**351.77**	**343.56**	**8.21**	**343.52**	**337.09**	**6.43**

Source: www.indiastat.com

Note: R-Requirement, A-Availability, Gap= A-R
Figures in parentheses are in percentage

Table 4.37: Requirement and Availability of rice certified/quality Seed in Karnataka (Qty. in quintals)

	Availability			Requirement			Gap
	Certified	Quality	Total	Certified	Quality	Total	
2015-16 (K)	1,87,606	33,226	2,20,832	2,48,760	25,931	2,74,691	-53,859 (-19.61)
2015-16 (R)	37,087	3,122	40,209	83,757	7,533	91,290	-51,081 (-55.95)
2016-17 (K)	1,71,830	29,466	2,01,296	2,55,754	28,901	2,84,655	-83,359 (-29.28)
2016-17 (R)	17,547	3,623	21,170	83,893	14,315	98,208	-77,038 (-78.44)

Note: Figures in parentheses are in percentage

Table 4.38: Requirement and Availability of red gram certified/quality Seed in Karnataka (Qty. in quintals)

	Availability			Requirement			Gap
	Certified	Quality	Total	Certified	Quality	Total	
2015-16 (K)	21,612	8,781	30,393	23,026	40,614	63,640	-33,247 (-52.24)
2016-17 (K)	30,538	21,298	51,836	23,861	42,089	65,950	-14,114 (-21.40)

Note: Figures in parentheses are in percentage

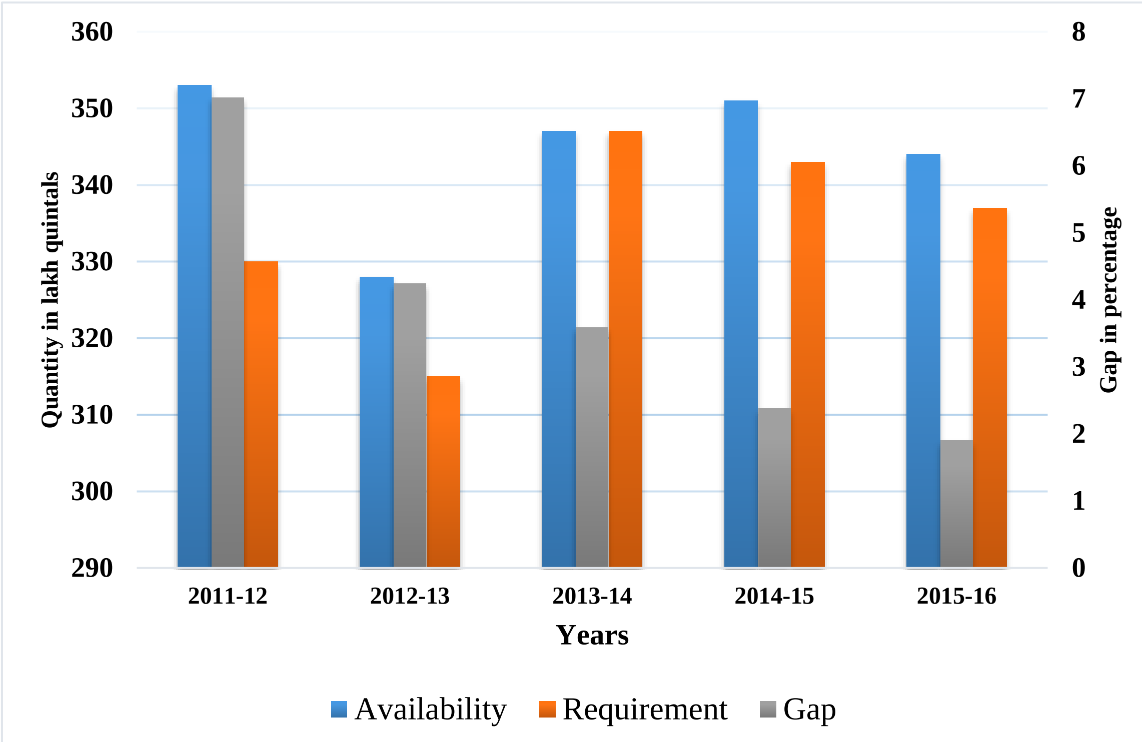

Fig. 4.10: Requirement availability and gap in certified seeds in India

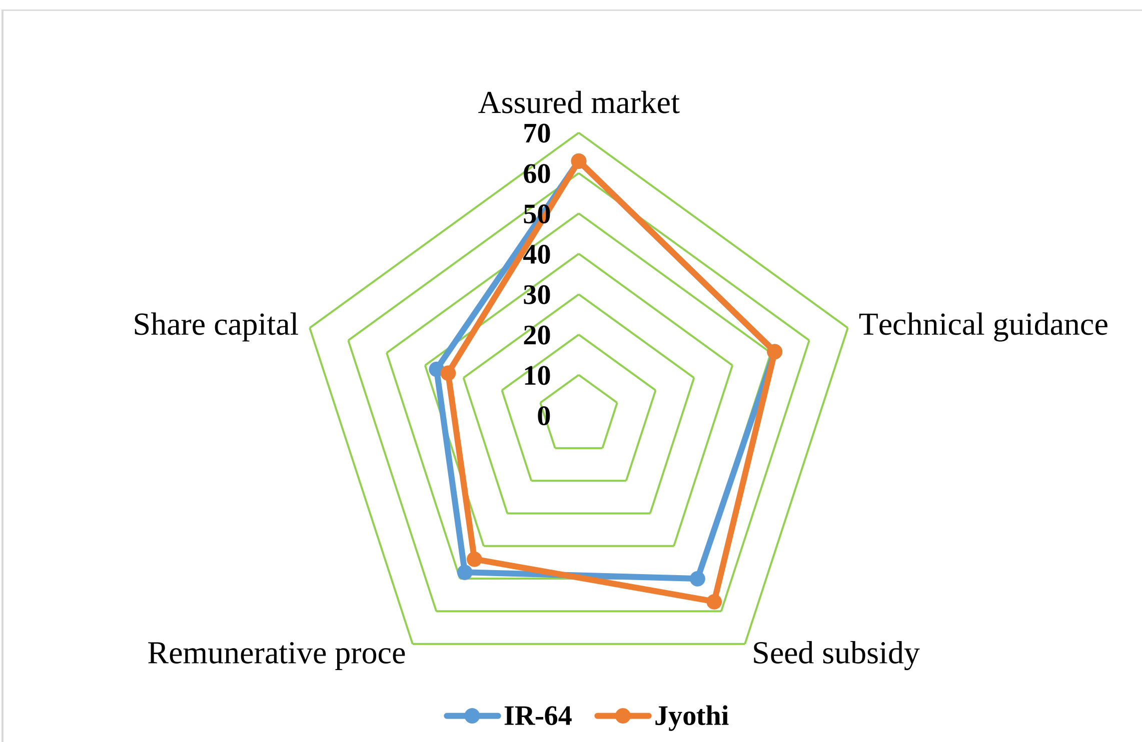

Fig. 4.11: Benefits ranked by respondents of IR-64 and Jyothi rice seed producers

Table 4.39: Requirement and Availability of sunflower certified/quality Seed in Karnataka (Qty. in quintals)

	Availability			Requirement			Gap
	Certified	Quality	Total	Certified	Quality	Total	
2015-16 (K)	274	6,076	6,350	4,399	11,254	15,653	-9,303 (-59.43)
2015-16 (R)	895	10,043	10,938	4,015	18,631	22,646	-11,708 (-51.70)
2016-17 (K)	340	8,426	8,766	4,289	11,254	15,543	-6,777 (-43.60)
2016-17 (R)	779	10,062	10,841	4,180	18,631	22,811	-11,970 (-52.47)

Note: Figures in parentheses are in percentage

Table 4.40: Requirement and Availability of IR-64 and Jyothi varieties of rice certified/quality Seed in Karnataka

(Qty. in quintal)

Years	IR-64							Jyothi						
	Availability			Requirement			Gap	Availability			Requirement			Gap
	C	Q	T	C	Q	T		C	Q	T	C	Q	T	
2015-16 (K)	32,716	200	32,916	43,104	0	43,104	-10188 (-24)	21,675	250	21,925	17,375	0	17,375	4,550 (26)
2015-16 (R)	1,893	0	1,893	8,770	252	9,022	-7129 (-79)	3,664	0	3,664	8,000	0	8,000	-4,336 (-54)
2016-17 (K)	27,936	200	28,136	42,605	0	42,605	-14469 (-34)	23,086	250	23,336	21,325	0	21,325	20,11 (9)
2016-17 (R)	1,441	0	1,441	9,370	250	9,620	-8179 (-85)	1,460	0	1,460	12,000	0	12,000	-10,540 (-88)

Source: Agriculture Department, Government of Karnataka, Bengaluru.

Note: K-Kharif season, R-Rabi season, C- Certified seeds, Q- Quality seeds, T-total and Figures in parentheses are in per centage

Table 4.41: Requirement and Availability of BRG-1 and BRG-2 varieties of red gram certified/quality Seed in Karnataka

(Qty. in quintals)

Years	BRG-1							BRG-2						
	Availability			Requirement			Gap	Availability			Requirement			Gap
	C	Q	T	C	Q	T		C	Q	T	C	Q	T	
2015	2,684	807	3,491	2,802	1,753	4,555	-1,064 (-23)	3,587	1,134	4,721	2,951	3,849	6,800	-2,079 (-31)
2016	4,507	1,021	5,528	3,302	1,661	4,963	465 (11)	5,866	5,187	11,053	4,426	4,191	8,617	2,436 (28)

Source: Agriculture Department, Government of Karnataka, Bengaluru.
Note: C- Certified seeds, Q- Quality seeds, T-total and Figures in parentheses are in percentage

Table 4.42: Requirement and Availability of KBSH-44 and KBSH-53 varieties of sunflower certified/quality Seed in Karnataka

(Qty. in quintals)

Years	KBSH-44							KBSH-53						
	Availability			Requirement			Gap	Availability			Requirement			Gap
	C	Q	T	C	Q	T		C	Q	T	C	Q	T	
2015-16 (K)	75	1	76	560	1	560	-484 (-86)	15	0	15	1,506	0	1,506	-1,491 (-99)
2015-16 (R)	200	0	200	850	0	850	-650 (-76)	322	0	322	1,255	0	1,255	-933 (-74)
2016-17 (K)	340	0	340	510	0	510	-170 (-33)	280	0	280	1,556	0	1,556	-276 (-82)
2016-17 (R)	188	0	188	850	0	850	-662 (-76)	332	19	351	1,250	0	1,250	-899 (-72)

Source: Agriculture Department, Government of Karnataka, Bengaluru.
Note: K-Kharif season, R-Rabi season, C- Certified seeds, Q- Quality seeds, T-total and Figures in parentheses are in percentage

Rice seed production: Opinion of respondents on the benefits and constraints in rice seed production are presented in Table 4.43 and Table 4.44. Majority of farmers opined that, the assured market is the main reason to take seed production under KSSC (63) in both the varieties, followed by technical guidance (51), seed subsidy (50), remunerative price (48) and share capital (37) in case of IR-64 variety. In case of Jyothi variety after assured market, famers opined that, the seed subsidy (57), technical guidance, remunerative price and share capital (34) are the following benefits for which they take seed production under KSSC.

Table 4.43: Opinion of respondents on the benefits in rice seed production

Sl. No.	Particulars	Score	Rank	Score	Rank
1	Assured market	63	1	63	1
2	Technical guidance	51	2	51	3
3	Seed subsidy	50	3	57	2
4	Remunerative price	48	4	44	4
5	Share Capital (dividend)	37	5	34	5

It is evident from the results that, lack of agricultural labour during peak seasons was the major general constraint in the production for both IR-64 and Jyothi variety seed growing farmers with a garrett score of 63 and 69, respectively followed by lack of availability and high price fertilizers (Rank II) and lack of pure and quality seeds (Rank III). With respect to the plant protection constraints, farmers growing IR 64 opined that high incidence of insect pest (56) was the major constraint whereas Jyothi variety growing farmers opined that high incidence of diseases (53) was the major constraint. Among credit constraints, high transaction cost was the major problem faced by both IR-64 and Jyothi variety growing farmers with a garrett score of 60 each followed by complex procedure in availing credit (Rank II) and timely un availability of loans (Rank III). In case of agro climatic factors, drought during critical stages of growth was ranked first followed by excessive rain. Fixed price of procurement agency irrespective of Market situation (73 and 62) and poor quality of inputs (68 and 53) were the major economic and institutional constraints faced by both IR 64 and Jyothi variety seed producing farmers.

Table 4.44: Opinion of respondents on the constraints in rice seed production

Sl. No.	Particulars	IR-64		Jyothi	
		Score	Rank	Score	Rank
(A) Production constraints					
(1) General Constraints					
	Lack of agricultural labour during peak seasons	63	1	69	1
	Lack of availability and high price of fertilizers	56	2	52	2
	Lack of pure and quality seeds	49	3	51	3
	Lack of availability of micro-nutrient fertilizers	45	4	49	4
	Lack of knowledge about recommended package of practices	37	5	43	5
(2) Plant protection constraints					
	High incidence of insect pest.	56	1	52	2
	High incidence of diseases	52	2	53	1
	Lack of availability of genuine plant protection chemicals	42	3	45	3
(3) Credit constraints					
	High transaction cost	60	1	60	1
	Complex procedure	58	2	58	2
	Timely unavailability	50	3	50	3
	High interest rate	43	4	43	4
	Lack of knowledge about sources	39	5	39	5
(C) Agro climatic Factors					
	Drought during Critical stages of growth	66	1	68	1
	Excessive Rain	46	2	46	2
	Variation in temperature	38	3	38	3
(D) Economic Constraints					
	Fixed price of procurement agency irrespective of Market situation.	73	1	62	1
	High input cost	26	2	38	2
(E)Institutional Constraints					
	Poor quality of inputs	31	1	53	1
	Poor Extension services	68	2	47	2

Redgram seed production: Opinion of respondents on the benefits and constraints in redgram seed production are presented in Table 4.45 and Table 4.46. In both varieties of redgram farmers scored the same rank, assured market was the major reason to take seed production with garrett score of 62 and 63 in BRG-1 and BRG-2 varieties, followed by seed subsidy, technical guidance, remunerative price and share dividend provided by the KSSC to the shareholders are reasons to take the seed production.

The major constraints among general constraints ranked by BRG-1 variety seed producing farmers were lack of agricultural labour during peak season (62), followed by lack of pure and quality seeds (55), lack of availability and high price fertilizers (51), lack of knowledge about recommended package of practices (47) and lack of availability of micro-nutrient fertilizers (33). Whereas the BRG-2 variety seed producing farmers opined lack of pure and quality seeds as the major constraint (69) followed by lack of agricultural labour during peak season (57), lack of availability and high price fertilizers (51), lack of knowledge about recommended package of practices (41) and lack of availability of micro-nutrient fertilizers (33) as the major constraints to take the seed production.

Under plant protection constraints in both the varieties farmer experienced high incidence of disease (57 and 59) as major constraint followed by incidence of insect pest (53 and 49) and lack of availability of genuine plant protection chemicals (39 and 40) as the constraints. In credit facilities at the study area, BRG-1 seed producing farmers felt complex procedure to avail credit has the major constraints (60) followed by high transaction cost (55), timely unavailability (50), high interest rate (48) and lack of knowledge about sources of credit availability (36) as the problems to take credits for seed production.

Table 4.45: Opinion of respondents on the benefits in redgram seed production

Sl. No.	Particulars	Score	Rank	Score	Rank
1	Assured market	62	1	63	1
2	Seed subsidy	55	2	57	2
3	Technical guidance	52	3	51	3
4	Remunerative price	51	4	44	4
5	Share Capital(dividend)	24	5	34	5

Table 4.46: Opinion of respondents on the constraints in redgram seed production

Sl. No.	Particulars	BRG-1		BRG-2	
		Score	Rank	Score	Rank
(A) Production constraints					
(1) General Constraints					
	Lack of agricultural labour during peak seasons	62	1	57	2
	Lack of pure and quality seeds	55	2	69	1
	Lack of availability and high price of fertilizers	51	3	51	3
	Lack of knowledge about recommended package of practices	47	4	41	4
	Lack of availability of micro-nutrient fertilizers	33	5	33	5
(2) Plant protection constraints					
	High incidence of diseases	57	1	59	1
	High incidence of insect pest.	53	2	49	2
	Lack of availability of genuine plant protection chemicals	39	3	40	3
(3) Credit constraints					
	Complex procedure	60	1	50	3
	High transaction cost	55	2	51	2
	Timely unavailability	50	3	62	1
	High interest rate	48	4	45	4
	Lack of knowledge about sources	36	5	37	5
(B) Agro climatic Factors					
	Drought during Critical stages of growth	71	1	73	1
	Variation in temperature	69	2	52	3
	Excessive Rain	61	3	46	2
(C) Economic Constraints					
	Fixed price of procurement agency irrespective of Market situation.	63	1	57	1
	High input cost	36	2	43	2
(D)Institutional Constraints					
	Poor quality of inputs	52	1	60	1
	Poor Extension services	39	2	24	2

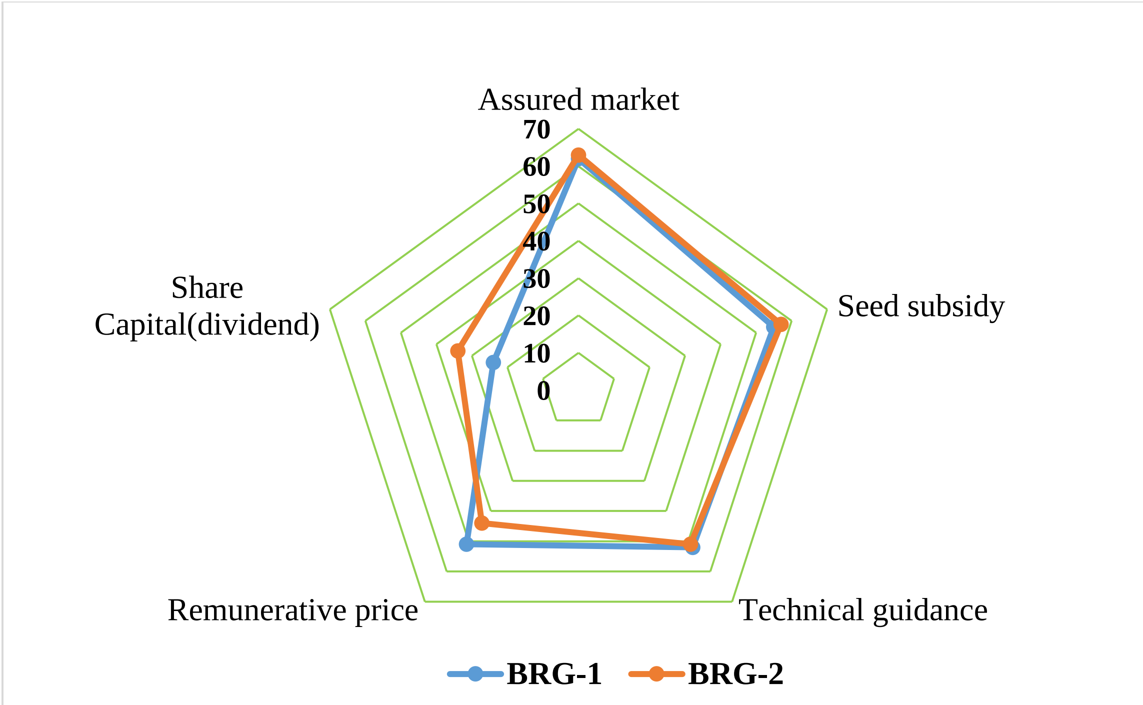

Fig. 4.12: Benefits ranked by respondents of BRG-1 and BRG-2 redgram seed producers

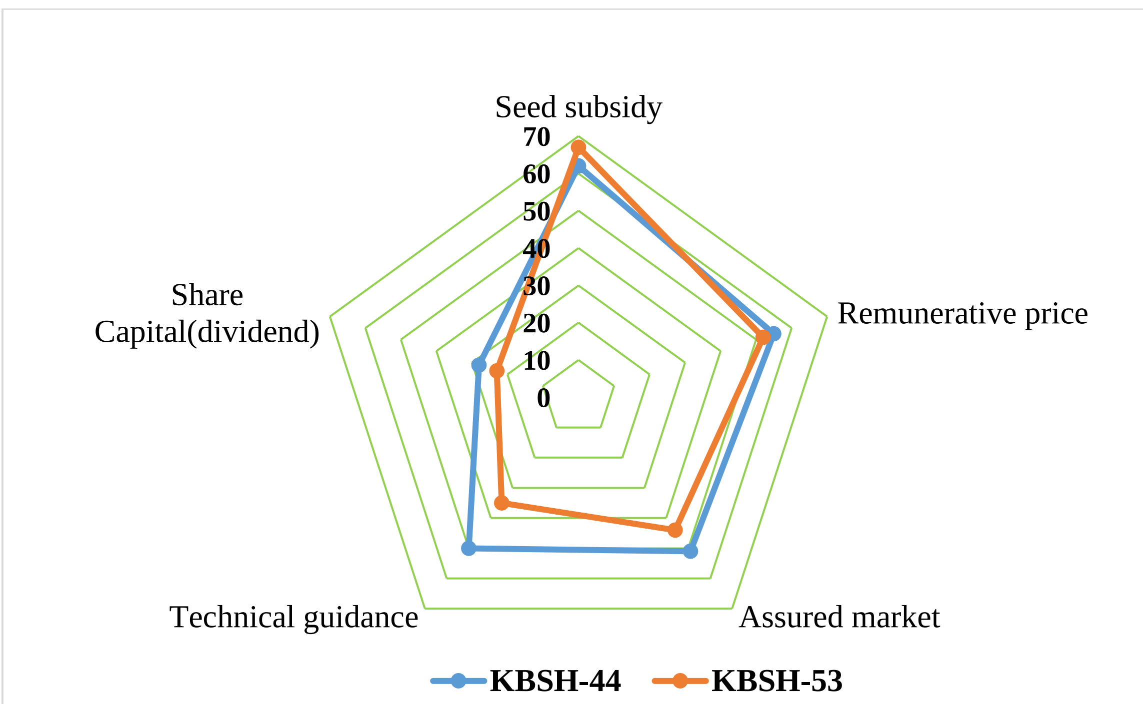

Fig. 4.13: Benefits ranked by respondents of KBSH-44 and KBSH-53 sunflower seed producers

The BRG-2 seed producing farmers opined timely unavailability of credit as the major constraint (62), followed by high transaction cost (51), complex procedure (50), high interest rate (45) and lack of knowledge about sources of credit availability (37) as constraints in getting credit for seed production.

Among climatic factors, drought during critical stages of growth as major constraint and fixed price of procurement agency irrespective of market situation under economic constraints and poor quality of inputs under institutional constraints were opined as major constraints from farmers of both the varieties.

Sunflower seed production: The benefits ranked by the farmers were same in both the varieties of sunflower. The major benefit because of which farmers take seed production were seed subsidy (62 and 67), followed by remunerative price (55 and 52), assured market (51 and 44), technical guidance (50 and 35) and lastly share capital given by KSSC (28 and 23) (Table 4.47)

The constraints in seed production shown in Table 4.48 indicated lack of agricultural labour during peak season (57 and 58) as the major constraint followed by lack of availability and high price fertilizers (56 and 56), lack of knowledge about recommended package of practices (52 and 53), by lack of pure and quality seeds (44 and 46) and lack of availability of micro-nutrient fertilizers (42 and 36) in KBSH-44 and KBSH-53 variety seed producing farmers, respectively under general constraints. In the plant protection section, KBSH-44 variety seed producing farmers opined high incidence of insect pest as major reason (56), followed by high incidence of disease (52) and lack of availability of genuine plant protection chemicals (42), whereas KBSH-53 variety seed producing farmers opined high incidence of disease (52), followed by high incidence of insect pest as major reason (46) and lack of availability of genuine plant protection chemicals (35) as the problems in seed production. Among the constraints to avail credits farmers opined high transaction cost (61 and 65) as major constraint, followed by complex procedure (55 and 58), timely unavailability (49 and 46), high interest rate (44 and 40) and lack of knowledge about sources (40 and 24) as the constraints in getting the credit to take seed production. The variation in temperature takes a major role in sunflower seed setting it has ranked has the major constraint with garrett score of 65 and 63 in KBSH-44 and KBSH-53 variety seed production, respectively.

Table 4.47: Opinion of respondents on the benefits in sunflower seed production

Sl. No.	Particulars	Score	Rank	Score	Rank
1	Seed subsidy	62	1	67	1
2	Remunerative price	55	2	52	2
3	Assured market	51	3	44	3
4	Technical guidance	50	4	35	4
5	Share Capital(dividend)	28	5	23	5

Table 4.48: Opinion of respondents on the constraints in sunflower seed production

Sl. No.	Particulars	KBSH-44		KBSH-53	
		Score	Rank	Score	Rank
(A) Production constraints					
(1) General Constraints					
	Lack of agricultural labour during peak seasons	57	1	58	1
	Lack of availability and high price of fertilizers	56	2	56	2
	Lack of knowledge about recommended package of practices	52	3	53	3
	Lack of availability of micro-nutrient fertilizers	42	5	36	5
	Lack of pure and quality seeds	44	4	46	4
(2) Plant protection constraints					
	High incidence of diseases	52	2	52	1
	High incidence of insect pest.	56	1	46	2
	Lack of availability of genuine plant protection chemicals	42	3	35	3
(3) Credit constraints					
	Lack of knowledge about sources	40	5	24	5
	Complex procedure	55	2	58	2
	High transaction cost	61	1	65	1
	Timely unavailability	49	3	46	3
	High interest rate	44	4	40	4
(B) Agro climatic Factors					
	Variation in temperature	65	1	63	1
	Drought during Critical stages of growth	47	2	46	2
	Excessive Rain	39	3	43	3
(C) Economic Constraints					
	Fixed price of procurement agency irrespective of Market situation.	52	1	58	1
	High input cost	47	2	42	2
(D)Institutional Constraints					
	Poor Extension services	55	1	57	1
	Poor quality of inputs	44	2	35	2

Plate 1: Primary data collecting from the seed growing farmer Nagaraj in Nagarle

Plate 2: Primary data collecting from the seed growing farmer Ranga reddy in Purigali

V SUMMARY AND CONCLUSION

A brief summary of the research along with major findings are presented in this chapter. Policy recommendations based on the results of the study are also proposed for planners and administrators.

In crop production, the response of all other inputs depends on quality of seeds to a larger extent. It is estimated that the direct contribution of quality seed alone to the total production is about 15 – 20 per cent depending upon the crop and it can be further raised up to 45 per cent with efficient management of other inputs. Seed cost forms very small part of the total cultivation expenses in field crops, but without the quality seeds any amount of expenditure on other inputs like fertilizers, pesticides will not yield adequate returns.

The major seed production taking crop under cereals is paddy, among pulses is redgram and among the oil seeds its sunflower. Rice is a staple grain and reflection of food security and also plays important role in socio-cultural and economical aspects of farmers. Redgram the protein rich pulse is also used as vegetable and forage crop. Nutritionally, the sprouted peas enhance digestibility via reduction of indigestible sugars. Besides oil, almost every part of sunflower has commercial value. It is used in the manufacturing of paints, resins, plastics, soap, cosmetics and many other industrial products. The sunflower crop has gained importance due to its short duration of maturity, excellent quality of oil, photo-insensitivity, and wide adaptability into different kinds of cropping pattern, high-energy hull and drought tolerance. It is a short duration crop and can be incorporated in to different types of cropping patterns.

This study aimed at providing an overall insight into the economics of seed production of rice (IR-64and Jyothi variety), redgram (BRG-1 and BRG-2) and sunflower (KBSH-44 and KBSH-53). The information/literature pertaining to the seed production issue is scanty, hence the study on “Economics of Seed Production of Selected Food grains in Karnataka” was chosen with the following objectives.

1. To estimate the cost and returns of certified seed production.

2. To assess resource use efficiency in seed production.
3. To assess the supply-demand gap in quality seed production.
4. To document the benefits and constraints in seed production.

The study was carried out in Mysuru district for rice seed production and Chikkaballapura district for redgram (BRG-1 and BRG-2) and sunflower (KBSH-44 and KBSH-53), as these districts are one among the major seed production taking districts.

Random sampling technique was employed in the selection of sample farmers among the list of seed producers provided by the KSSC. Thirty farmers cultivating each variety viz; IR-64 and Jyothi varieties of rice, BRG-1 and BRG-2 varieties of redgram and KBSH-44 and KBSH-53 varieties of sunflower were selected randomly in the study area.

Data on socio-economic aspects, per hectare costs and returns of crops, land holdings, farm equipment/ assets, constraints in seed production and also the relevant data on variables required for evaluating the objectives of the study were collected from the farmers using pre-tested, well-structured schedule through personal interview method for the agricultural year 2016-17. The data collected were purely based on the memory of the respondents. Secondary data regarding demand and supply of certified seeds in Karnataka for the study were collected from the Department of Agriculture, Government of Karnataka, Bengaluru.

Cost and returns in seed production of rice, redgram and sunflower was calculated by computing both variable and fixed costs, net returns from seed production was arrived at by subtracting the total cost of cultivation from gross returns which includes returns from both the accepted and rejected seeds, as the rejected seeds will be sold in local markets. Cobb-Douglas type of production function per farm was used to analyse the resource use efficiency. DEA (Data envelopment analysis) method was used to find technical, allocative and economic efficiencies of the farms. Appropriate statistical tests were used to analyse the supply-demand gap of certified/quality seeds in India and Karnataka. Garrett raking was used to rank the benefits and constraints of seed production

Major findings of the study

- The sample farmers in all the three crops were homogeneous with respect to the socio-economic characters.

- Per hectare cost of production of certified seeds of IR-64 and Jyothi varieties of rice were ₹ 1,242 /q and ₹ 1,408 /q, respectively. Variable costs accounted for 75 per cent in IR-64 and 76 per cent in Jyothi variety seed production

- Analysis of cost structure revealed that Rs 26,426 (30 %) and Rs 22,236 (26 %) of total cost of cultivation per hectare was incurred on labour in IR-64 and Jyothi varieties, respectively, indicating that seed production is labour intensive. Hence, the hypothesis, the labour cost forms more than 25 per cent of cost of cultivation is accepted.

- Yield (accepted and rejected) was higher in IR-64 (68.84 q/ha) compared with Jyothi variety (62.44 q/ha). Jyothi variety (₹ 2,500 /q) received marginally higher price than IR-64 variety (₹ 2200 /q), hence the gross returns and net returns figures were higher in case of Jyothi variety.

- Comparison with conventional production of rice indicated less cost of cultivation (₹ 76,239) and net returns (₹ 39,854) with ₹ 1.52 of returns per rupee of expenditure per hectare.

- The difference between cost of production for IR-64 and Jyothi varieties was significant at one per cent. The result indicated that there is significant difference in the cost of production among the varieties.

- Variable costs accounted for 72 per cent in BRG-1 and 68 per cent in BRG-2 variety. The per hectare analysis of cost structure revealed that, total cost of cultivation (₹ 58,989), net returns (₹ 33,946) and returns per rupee of expenditure (1.58) were higher in BRG-1 than the seed production of BRG-2 [cost of cultivation: ₹ 51,768, net returns: ₹ 29,122, returns per rupee of expenditure: 1.56] which is because of low yield in case of BRG-2.

- Labour cost formed the major component in cost of cultivation and was 32 per cent and 34 per cent of cost of cultivation in BRG-1 and BRG-2 seed production, respectively.

- Per quintal cost of production of certified seeds of BRG-1 and BRG-2 varieties of redgram was ₹ 3,830 and ₹ 3,779, respectively and the difference was significant.

- The conventional red gram cultivation showed ₹ 1.49 returns per rupee of expenditure which was lower than that in BRG-1 (₹ 1.58) and BRG-2 (₹ 1.56) seed production, indicating that seed production is profitable.

- In sunflower, the per hectare analysis of cost structure revealed that, total cost of cultivation was higher in KBSH-53 (₹ 1, 03,329) than in KBSH-44 (₹ 1, 02,949). But higher net returns (₹ 87,941) and returns per rupee of expenditure (₹ 1.85) where found in KBSH-44 than in KBSH-53 which showed net returns (₹ 75,131) and ₹ 1.73 returns per rupee of expenditure.

- Labour cost accounted for 49 per cent of total cost of cultivation in KBSH-44 and 50 per cent in KBSH-53 variety, indicating that seed production is labour intensive.

- Per quintal cost of production of certified seeds of KBSH-44 and KBSH-53 varieties of sunflower was ₹ 6,557 and ₹ 7,175, respectively and there exists a significant difference in cost between KBSH-44 and KBSH-53.

- The cost of production in conventional sunflower production showed much lower figures compared to seed production. The return per rupee of expenditure in conventional production was ₹ 1.51, showing that the seed production is more profitable.

- Regarding inputs the difference in the value of FYM, fertilizers, plant protection chemicals, machine labour and bullock labour in IR-64 and Jyothi varieties were statistically significant.

- In case of redgram, the difference in the cost of FYM and human labour across BRG-1 and BRG-2 varieties were statistically significant. Fertilizer cost, plant protection chemical, human labour, machine labour and bullock labour were significant across varieties.

- Labour utilization pattern showed that much of the labour was used for raising nursery and transplanting in rice, for weeding and harvesting in redgram and for pollination in sunflower. Roughing is the major labour-intensive operation in seed production.

- In redgram, human labour in BRG-1 and fertilizers and human labour in case of BRG-2 varieties had ratio MVP/MFC of more than one, indicating their underutilization and hence the profitability can be increased by using more of these resources.

- The inputs, plant protection chemical and human labour in KBSH-44 and area in KBSH-53 were significant and showed the ratio more than one indicating underutilization of resources.

- Majority of rice seed producing farms were efficient [technical efficiency (0.90 and 0.92 in IR-64 and Jyothi, respectively), allocative efficiency (0.91 and 0.92, in IR-64 and Jyothi, respectively) and economic efficiency (0.83 and 0.85in IR-64 and Jyothi, respectively].

- In case of redgram seed production technical efficiency (0.98), allocative (0.93) and economic efficiency (0.91) of BRG-1 farms were more than in BRG-2, which showed 0.81, 0.70 and 0.56 technical, allocative and economic efficiencies, respectively. The low seed set due to weather calamities and low yield resulted the inefficiencies in BRG-2 varietal seed production.

- In Sunflower seed production, average technical, allocative and economic efficiencies were 0.83, 0.81 and 0.79, respectively in KBSH-44 and 0.83, 0.80 and 0.78 in KBSH-53, respectively.

- Requirement (demand) and availability (supply) gap analysis showed that there exists narrow gap at national level when compared to state level. The gap in certified/quality seed production is decreasing from year to year at national level.

- Majority of the rice and redgram seed producing farmers opined that, assured market was the major benefit they received from seed production where as in sunflower, farmers opined that seed subsidy was the major benefit.

- Constraints analysis indicated that labour scarcity at peak season was the major constraint as seed production is labour intensive.

Policy recommendations

- There is an increasing demand for certified seeds. Therefore, there is a need to expand area under seed production by giving the remunerative price and by decreasing the payment time, to make the quality seeds available to farmers at right time and at reasonable price.

- The resource use efficiency analysis revealed that there is a scope for reorganizing the expenditure, so efforts are needed to educate farmers about seed production and package of practices which also leads to increase in yield, increased profitability in seed production.

- Greater efforts may be made to extend extension services to provide appropriate technical information to farmers and to bridge the communication gap between KSSC and farmers.

- Farm mechanization must be encouraged, particularly during the peak seasons to ward off labour supply demand gap. Further extending custom hiring services would help in addressing labour problem.

- Seed production is economically viable, with more investment than that is needed in conventional cultivation. Therefore, appropriate institutional arrangements need to be developed to provide adequate credit facilities to seed growers.

VI REFERENCES

AGARWAL, R.L., 1980, *Seed Technology*, Oxford & IBH *Publishing* Company Pvt. Limited India.

ADHIKARI, D. P., 2013, Market information study for analysing national demand, supply, import and export situation of vegetable seeds in Nepal. *Proc. Vegetable Seed Project* (III) Centre for Environmental and Agricultural Policy Research, Extension and Development (CEAPRED) Nepal.

AKIGHIR, D. T. AND SHABU, T., 2011, efficiency of resource use in rice farming enterprise in Kwande local Government area of Benue State, Nigeria. *Int. J. Human. Social Sci.*, **1** (3): 215-220.

AKSHATHA, B. A., 2017, A comparative economic analysis of vegetable and grain redgram production in Karnataka. *M. Sc. (Agri.) Thesis (Unpub.)*, Univ. Agric. Sci., Bengaluru.

ANONYMOUS, 2011, Challenges of Food Security and its Management 2011, National Rainfed Area Authority, New Delhi, India.

ARUNKUMAR, S., 2002, Economics of contract farming in vegetables – A case of Belgaum district. *M. Sc. (Agri.)* Thesis *(Unpub.)*, Univ. Agric. Sci., Dharwad.

ASODIYA, S. P., PATEL, K. S., ASODIYA, P. S., AND PARMAR, V. K, 2014, Input use, costs structure, return and resource use efficiency analysis of wheat crop in south Gujarat, India. *Int. J. Agr. Ext***.** **2** (1): 5-12.

CHULAKI, B. M., 2001, Production and marketing of hybrid cotton seed in Northern Karnataka –An economic analysis. *M. Sc. (Agri.) Thesis (Unpub.)*, Univ. Agric. Sci., Dharwad.

GANESHKUMAR, A., MEHTA, R., PULLABHOTLA, H., PRASAD, S. K., GANGULY, K. AND GULATI, A., 2012, Demand and Supply of Cereals in India 2010- 2025, IFPRI Discussion Paper 01158, IFPRI New Delhi, India.

GUNDAPPAGOL, B. J., 2014, Management efficiency of vegetable growers of Belgaum district. *M.Sc. (Agri.) Thesis, (Unpub.),* Univ. Agric. Sci., Dharwad.

HEMANTKUMAR AND SINGH, R., 2005, Success and failure of contract farming in Himachal Pradesh: A Case Study of Cauliflower Seed Production. *Indian J. Agric. Market.*, **19** (2): 170.

JAGADEESH, N. P., 2011, Economic efficiency of contract farming models in medicinal plants – An economic analysis, *M.Sc. (Agri.) Thesis, (Unpub.),* Univ. Agric. Sci., Dharwad.

JAMADAR, M. I., SAJJAN, A. S AND KUMAR, S., 2013, Economic analysis of seed production in transplanted pigeonpea. *International Journal of Commerce and Business Management.* **7**(1): 63-66.

KANANNAVAR, P. S., CHILUR, R., VASANTHGOUDA, B. R., RAVINDRA, Y AND NAGARAJ, D.M., 2013, The economic analysis of sunflower production. *Int. J. Agr. Eng*. **6** (1): 227-230.

KANNABABU, N. AND RANA, B. S., 2003, The economics of sorghum hybrid seed production. *Seed Res.*, **31** (1): 1-7.

KASHIKAR, R., 2012, Economics of production and marketing of hybrid rice seed in Madhya Pradesh *Ph. D. Thesis*, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh.

KUMAR, J., AND KUMAR, P., 2008, contract farming: problems, prospects and its effect on income and employment. *Agric. Econ. Res. Rev.*, **21**: 243 250.

LAKEW, T., AND ALEMU, D., 2012, Approaches and procedures of seed demand assessment in the formal seed sector. *Proc Empowering Farmers' Innovation* series no. 5, Ethiopia.

MADALIA, V. K AND PATEL, A. R., 1984, Economics of hybrid cotton seed production. *Seeds and Farms,* **9** (6): 15-19.

MENASINAHAL, A. S., 2011, Performance of cotton in traditional paddy fields of Uttar kannada district, Karnataka – an economic analysis. *M. Sc. (Agri.) Thesis (Unpub.)*, Univ. Agric. Sci., Dharwad.

MULIMANI, S.T., 2015, Analysis of contract farming in selected seed production crops in Haveri district, Karnataka *M. Sc. (Agri.*) *Thesis (Unpub.)*, Univ. Agric. Sci., Bangalore.

NAGARAJ, N., SHANKAR, K. and CHANDRAKANTH, M. G., 2002, Pricing of irrigation water in Cauvery basin. Economic and Political Weekly, **5** (2):181-194.

NAIK, B., RANGANATHSASTRY AND HOSAMANI, S. B., 1996, Generating better income: Economics of tomato seed production in Dharwad district. *Karnataka J. of Agric. Sci.*, **9** (2): 369-371.

NARAYANAKUTTY, C., INDIRADEVI, P. AND JAIKUMARAN, V., 1998, Economics of vegetable seed production in Kerala state: A case study. *Seed Res.*, **26** (1): 47-52.

OYINBO, O., DAMISA, M. A. AND REKWOT, G. Z., 2013, Growth trend of rice demand and supply in Nigeria: an investment opportunity for youth and women empowerment. *Russian Journal of Agricultural and Socio-Economic Sciences*, **4** (16):31-34.

PAL, G., CHANNANAMCHERY, R., SINGH, R. K., KETHINENI, U. B., RAM, H. AND PRASAD, R. S., 2016, An economic analysis of pigeonpea seed production technology and its adoption behaviour: Indian context article. Scientific World Journal, doi: 10.1155/2016/7973638.

PATIL, S. P., GANESHKUMAR, D. AND VANITA, K., 2016, Food security with reference to demand-supply gaps and projections of food grains in Akola district, *Int. J. Of Agri. Sci*. **8** (37):1771-1773.

RADHA, Y., AND CHOWDRY, K, R., 2005, Comparative economics of seed production vis-a-vis commercial production of cotton in Andhra Pradesh. *Int. J. Of Agri. Econ*. **60** (1): 94-102.

RADHAKRISHNA, R., AND VENKATAREDDY, K., 2002, Food Security and Nutrition: Vision 2020. Planning Commission, New Delhi.

REDDY, L. E. AND REDDY, R. D., 2013, A Study on resource use efficiency of input factors with reference to farm size in paddy cultivation in Nellore District. *J. Humanities and Social Science,* **17** (1): 48-55.

SANDIGODMATH, N. M., 2011, Sunflower seed production under contract farming in Haveri district, Karnataka – An economic analysis. *M. Sc. (Agri.*) *Thesis (Unpub.)*, Univ. Agric. Sci., Bengaluru.

SANNAMANI, N. M., 2014, An economic analysis of tomato hybrid seed production under contract farming in Haveri district *M. Sc. (Agri.) Thesis (Unpub.)*, Univ. Agric. Sci., Dharwad.

SATISHKUMAR, M., 2017, Farm Mechanization vis-a-vis agricultural labour scarcity: Impact on income of farm households in Karnataka. *Ph.d Thesis (Unpub.)*, Univ. Agric. Sci., Bengaluru.

SEKHON, K. S., 2012, Economic analysis of production and marketing of sunflower in Punjab. *M.Sc. (Agri.) Thesis, (Unpub.)*, Punjab Agric. Univ., Ludhiana**.**

SURESH, A. AND REDDY, K. T. R., 2006, Resource-use efficiency of paddy cultivation in Peechi command area of Thrissur district of Kerala: An Economic Analysis. *Agric. Econ. Res. Rev.*, **19** (2):159-171.

TRILOKANATHA, G. A., 2013, Analysis of supply, demand and price behaviour of major pulses of India. *M. Sc. (Agri.*) *Thesis (Unpub.)*, Univ. Agric. Sci., Bengaluru.

VASANTHI, R., CHANDRASEKARAN, M. AND SELVI, P. R., 2015, Estimation of farm level technical efficiency in rice farmers of tank irrigated systems in Tamil Nadu – A stochastic frontier approach. *Annals of Plant and Soil Res*, **17** (4): 238-242.

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APPENDIX

	DEPARTMENT OF AGRICULTURAL ECONOMICS, **UNIVERSITY OF AGRICULTURAL SCIENCES, GKVK,BENGALURU.**

TITLE : "Economics of Seed Production of Selected Food grains in Karnataka"

SCHEDULE

Name of investigator: Thejashree, H. N. **Date:**

I. General information:

1.Name of Farmer :

2.Village :

3.Taluk :

4.Age (Years) :

5.District :

6. Mobile No :

7. Education :

8. Occupation :

9.Family size and composition:

	Male	Female	Children
Total :	………..	………..	

II. Cropping pattern

Sl. No.	Kharif		Rabi		Summer	
	Crop	Area (ac)	Crop	Area (ac)	Crop	Area (ac)
Rainfed						
1						
2						
Irrigated						
1						
2						
3						
Perennials						
1						
2						

III. Land holding pattern:

Sl. No.	Type	Irrigated area (acre)			Dry land area (acre)
		Open-well	Tube-well	Tank	
1.	Own land				
2.	Leased in				
3.	Leased out				

IV. Farm machinery/ Equipment's/Assets:

Sl. No.	Particulars	No's	Year of purchase	Purchase value (Rs.)	Average life (Years)	Annual repairs (Rs.)
1	Bullock cart					
2	Seed drill					
3	Wooden / M.B. Plough					
4	Power tiller					
5	Tractor and accessories					
6	Sprayers					
7	Irrigation pump (IP Set)					
8	Electric motor					
9	Tube well / Open Well					
10	Farm Building/ Pump house					
11	Cattle Shed					
12	Others					

V. Household assets:

Sl. No.	Particulars	No's	Year of purchase/Construction	Present value (Rs.)
1	House			
2	Television			
3	Mobile			
4	Refrigerator			
5	2 Wheelers			
6	4 Wheelers			
7	Others			

Income from various sources:

Sl. No.	Source	Rs
1	Crop production	
2	Livestock	
3	Sericulture	
4	Off Farm	
5	Non farm	

Details on Borrowings:

Source	Purpose	Amount	Amount repaid	Interest rate
Commercial Bank				
Co-operative institutions				
Regional rural banks				
PACS				
Gold loan				
Money lenders				
Traders				
Others				

VI. Cost of cultivation:

- Crop :
- Season :
- Variety
- Rainfed / Irrigated
- Area :
- Seed replacement : Yes/ No
- Duration :

Wage rate (Rs/day)	
Men labour/day	
Women labour/day	
Bullock pair/day	
Machine labour/hour	

A. Labour use pattern:

Sl. No.	Name of the operation	NO. of times	Family		Hired		Bullock pair days	Machine hours
			Men days	Women days	Men days	Women days		
1	Land Preparation							
2	Nursery							
3	Seed treatment							
4	Sowing/Transplanting							
	Male lines							
	Female lines							
5	Manure Application							
6	Inter cultivation							
7	Weeding							
8	Roughing							
9	Removal of Pollen shedder							
10	Pollination							
11	Fertilizer application							
12	Plant protection							
13	Irrigation							
14	Harvesting							
15	Threshing							
16	Cleaning / Bagging							
17	Loading / Unloading							
18	Others							

B. Resource use pattern:

Sl. No.	Input	Quantity	Unit	Price/Unit
1	Seeds			
	Male lines			
	Female Lines			
2	FYM			
3	Fertilizers a) b) c) d)			
4	PP chemicals a) b) c)			
5	Weedicides a) b)			
6	Seed treatment			
7	Electricity			
8	Irrigation			

Water Purchase:

Crop	Area	Frequency/season	Quantity	cost

C. **Yield and returns**:

Sl. No.	Particulars	Unit	Yield	Price (Rs.)
1.	Main product			
	Accepted			
	Rejected			
2.	By-Product			
	B-line Seeds			
	Straw			
	Others			

VII. Post harvest activities

Grading (Yes/No)		
No. Of labours used	**Cost of labour**	**Other information**

Packing Details		
Material type	**Material Cost**	**Other information**

Transprtation Details					
Mode of transportation	**Quantity transported**	**Destination**	**Distance**	**Transportation cost**	**Other information**

- Main product will be marketed to KSSY/NSP, But what about by-product?

…...

- Quantity of main product rejected during certification?.......................................
- Reason for the rejection?..
- Do you employ any tests to ascertain the quality of the seeds produced?

………………………………………………………………………………...

- Number of field visits by KSSC/NSP scientists?..
- Where did you get the information regarding seed production/ Technical guidance for the seed production?.................................

Institutional Participation:

Sl. No.	Institutions	Type of Participation
1	Self-Help groups	
2	Co-operatives	
3	Panchayat	
4	Producers Association	
5	Others	

Insurance details:

	Insurance	Rupees
A	-Crop insurance premium	
B	-Livestock insurance premium	
C	- Farm equipment &Vehicle insurance premium (specify)	

Have you claimed any insurance premium?…………………………

VII. Opinion of respondents on the benefits and constraints in Production.

Benefits

Sl No	Particulars	Rank
1	Seed subsidy	
2	Technical guidance	
3	Remunerative price	
4	Assured market	
5	Share Capital(dividend)	

Constraints

Sl. No.	Particulars	Rank
(A) Production constraints		
(2) General Constraints		
	Lack of pure and quality seeds	
	Lack of agricultural labour during peak seasons	
	Lack of availability and high price fertilizers	
	Lack of availability of micro-nutrient fertilizers	
	Lack of knowledge about recommended package of practices	
(2) Plant protection constraints		
	High incidence of diseases	
	High incidence of other insect pest.	
	Lack of availability of genuine plant protection chemicals	
(3) Credit constraints		
	Lack of knowledge about sources	
	Complex procedure	
	High transaction cost	
	Timely unavailability	
	High interest rate	
(B) Agro climatic Factors		
	Variation in temperature	
	Excessive Rain	
	Drought during Critical stages of growth	
(C) Economic Constraints		
	High input cost	
	Fixed price of procurement agency irrespective of Market situation.	
(D)Institutional Constraints		
	Poor quality of inputs	
	Poor Extension services	