COMPARATIVE ECONOMICS OF MALDANDI (M 35-1) VS PHULE REVATI VARIETY OF SORGHUM IN SOLAPUR DISTRICT OF MAHARASHTRA.

by

Mr. Dhanave Mukesh Dilipkumar
(Reg. No. K-19/215)

AGRICULTURAL ECONOMICS SECTION
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A Thesis submitted to the
MAHATMA PHULE KRISHI VIDYAPEETH,
RAHURI- 413 722, DIST- AHMEDNAGAR,
MAHARASHTRA, INDIA.

In partial fulfilment of the requirements for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

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2021

CANDIDATE'S DECLARATION

I hereby declare that this thesis or part
there of has not been submitted
by me or other person to any
other University or Institute
for a Degree or
Diploma

Place: Kolhapur

Date: / / 2021 (M. D. Dhanave)

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CERTIFICATE

This is to certify that the thesis entitled, **"COMPARATIVE ECONOMICS OF MALDANDI (M 35-1) VS PHULE REVATI VARIETY OF SORGHUM IN SOLAPUR DISTRICT OF MAHARASHTRA"** submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri Dist. Ahmednagar (M.S.) in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL ECONOMICS,** embodies the results of a piece of bonafide research work carried out by **Mr. DHANAVE MUKESH DILIPKUMAR,** under my guidance and supervision and that no part of the thesis has been submitted for any other degree or diploma.

The assistance and help received during the course of this investigation have been duly acknowledged.

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Place: Kolhapur

Date: / /2021 *(M. D. Dhanave)*

ABSTRACT

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The present study entitled, 'Comparative Economics of Maldandi (M 35-1) vs Phule Revati Variety of Sorghum in Solapur District of Maharashtra.' is based on a sample of 108 Sorghum growers drawn from Mangalwedha and Barshi Tahsils of Solapur district of Maharashtra. In present study, the per hectare costs and returns of sorghum, resource use efficiency, marketing cost, marketing margin, price spread and constraints in sorghum cultivation and marketing were studied. The factors affecting yield of Maldandi and Revati were estimated by using the Cobb-Douglas type production function. The data pertained to the agricultural year 2019-20 was used for simple and functional analysis. The present study "Comparative Economics of Maldandi (M 35-1) vs Phule Revati Variety of Sorghum in Solapur District of Maharashtra" was done with objectives *viz;* to find out costs and returns of M 35-1(Maldandi) and Revati cultivar of sorghum, to estimate the resource use efficiency of Sorghum, to study the marketing costs, price spread and marketing efficiency of sorghum and problems faced by growers in the production and marketing of sorghum.

Solapur district, having the highest Sorghum production, the highest sorghum producer tehsils *viz*; Mangalwedha and Barshi tehsils were selected purposively. Three villages from each tehsil i.e. Borale, Mangalwedha, Mundhewadi from Mangalwedha tehsils and Vairag,

Soundare and Mandegaon from Barshi tehsil were selected randomly. From each village nine M 35-1(Maldandi) growers and nine Revati growers were selected as sample sorghum growers. Thus, the total sample size for the study will consists of 108 sorghum growers comprising 36 for each size group.

M 35-1 (Maldandi) and Revati Sorghum occupied 19.87 and 10.88 per cent of the gross cropped area and the cropping intensity were 173.30 and 168.09 per cent at overall level. At overall level, the total land holding were 1.90 and 2.53 ha of which 1.79 and 2.41 ha area was net cropped area for M 35-1(Maldandi) and Revati. Cost of cultivation, at overall level, average per hectare cost of cultivation of M 35-1 and Revati were ₹ 58365.55 and ₹ 86724.73. The production at overall level, average per hectare production of M 35-1 (Maldandi) and Revati were 15.8 and 35.2 quintals. Disposal of produce was 90.19 per cent of the quantity was sold for M 35-1(Maldandi) and for Revati, it was 95.26 per cent. The per hectare inputs utilization of seed for M 35-1(Maldandi) and Revati at overall level were 12.24 and 12.67 kg seed, 63.96 and 68.56 qtl. manures. Average per hectare gross income for M 35-1(Maldandi) was Rs.91739.67 and for Revati was Rs.166152.17. The benefit-cost ratio for M 35-1(Maldandi) was 1.57 at the overall level and it was found higher in case of Revati i. e. 1.93.

The results of Cobb-Douglas type production function analysis revealed that the factors *viz*., male, female, manures, and irrigation were found positive and significant thereby influencing the yield of M 35-1 (Maldandi) and for Revati seed, potassium, irrigation and plant protection charges were found positive and significant. The coefficient of Multiple Regression (R^2) for M 35-1(Maldandi) and Revati were 0.96 and 0.94. It indicates that the variable under consideration i. e. selected resources explained 96 and 94 per cent variation in output of M 35-1 and Revati variety respectively.

The total marketing cost and market margin was more in channel-II of M 35-1(Maldandi) and Revati cultivar. Price spread is maximum in Revati as compared to M 35-1 (Maldandi). Channel II is most preferred channel for marketing of M 35-1 and Revati Sorghum.

The major constraints in production of M 35-1(Maldandi) and Revati were non-availability of labour followed by high wage rate, quality of produce and non-availability of input in time etc. High transportation charges is the major problems in marketing of M 35-1(Maldandi) and Revati followed by high commission rate, lack of intelligence and delay in payment.

1. INTRODUCTION

1.1 General

The most important crop for food and fodder is sorghum (*Sorghum bicolor* L.). It has also called great millet, jowar/jowari, and other names. After rice, wheat, maize, and barley, “sorghum is the world's fifth most significant cereal crop”. Sorghum is a grain that originated in Africa and is now grown all over the world in tropical and subtropical climates. Sorghum is an annual plant of the Graminae family (Anonymous, 2019).

Sorghum is an important crop in the dry and semi-arid tropics of the world, providing food, feed, and fodder. Sorghum is sometimes known as "coarse grain." The cereal is used for starch and ethanol production, the fabrication of adhesives and paper, and the creation of grain alcohol, among other things. (Nirgude *et al*., 2017)

It is one of the world's most important staple food crops for the poor and the food insecure. (Basavaraja *et al*., 2005). Sorghum has adaptable characteristics that allow it to thrive in locations where other main crops like wheat, maize, and rice would fail (Haussmann *et al*. 2000); Rami *et al.*, 1998., B. Dayakar Rao *et al*., 2017).

Sorghum is a belittled, nutrient-rich cereal grain. Half a cup of unprepared sorghum (96 grams) provides

- Calories: 316
- Protein: 10 grams
- Fat: 3 grams
- Carbohydrates: 69 grams
- Fiber: 6 grams
- Vitamin B1 (thiamine): 26% of the Daily Value (DV)
- Vitamin B2 (riboflavin): 7% of the DV
- Vitamin B5 (pantothenic acid): 7% of the DV
- Vitamin B6: 25% of the DV
- Iron: 18% of the DV
- Zinc: 14% of the DV

Sorghum contains a wide range of nutrients, including B vitamins, which are important for metabolism, neurological development, skin and hair health. It has also high in magnesium, a mineral that plays a role in bone development, heart health, and over 600 metabolic activities in the body, including energy synthesis and protein metabolism. Sorghum also contains a lot of antioxidants, such as flavonoids, phenolic acids, and tannins. Antioxidant-rich foods can help to reduce oxidative stress and inflammation in the body (Anonymous, 2019).

Sorghum is an important crop in the dry and semi-arid tropics of the world, providing food, feed, and fodder. It is a staple diet for the country's and African countries' rural poor.

Sorghum is sometimes known as "coarse grain." Sorghum demand for feed is the primary driving reason behind increased global output and international trade. Alcohol is made from sorghum, particularly kharif sorghum. Forage, hay, and silage are made from the entire plant. (Sonawane *et al*., 2017).

1.2 Importance of sorghum in India

Sorghum is used for a variety of purposes, including human nourishment, livestock feed, and industrial applications such as the manufacturing of beer, syrup, and ethanol. Sorghum is currently consumed mostly by humans in low-income nations such as India and Nigeria, but it is also used as a component in livestock feed and to make ethanol in high-income countries such as the United States and Mexico. India pays 16% of the world's sorghum production (Jimjel Zalkuwi *et al.,* 2015)

Sorghum is utilised as human food, fodder, chicken feed, cattle feed, and industrial raw materials, among other things. Sorghum is commonly used in the creation of papad, cookies, and other dishes. Animals eat the green leaves and stalks as feed. Sorghum is widely utilised as poultry feed in the poultry business. Sorghum is utilised in a variety of industries, including the manufacturing of alcohol (Ethanol), jaggery, syrup, spirit, and starch. Alcohol is a commonly utilised basic ingredients in industry. It is made using both sweet staked sorghum and grains as the raw material (Hile *et al.,* 2013)

M 35-1(Maldandi) Jowar is a traditional grain variety from Solapur District's Mangalwedha Taluka. M 35-1(Maldandi) Jowar is particularly well-known for its sweet flavour and nutritional benefits. The grain is robust and glossy, with a thin pericarp. It produces the highest grain yield and quality, as well as the highest fodder yield and quality. This type is dominant in India's post-monsoon sorghum areas. ICRISAT (International Crops Research Institute for the Semi-Arid Tropics) generated several varieties with M 35-1(Maldandi) genes (M-35-1). M 35-1(Maldandi) Jowar roti is commonly regarded as the greatest in terms of taste and softness. In comparison to other types of Jowar, M 35-1(Maldandi) Jowar has a high percentage of glucose. (Anonymus, 2016).

Phule Revati produced 4.6 tonnes/ha in irrigated areas, which was 41.8 per cent more than CSV 18 (3.2 tonnes/ha), 21.4 per cent more than Phule Yashoda (3.78 tonnes/ha), 16.1% more than M 35-1(Maldandi) (3.4 tonnes/ha), 19.8% more than PKV Kranti (3.8 tonnes/ha), and 35.3 per cent more than Parbhani Moti (3.4 tonnes/ha). In the areas tested, its fodder yield was 11.5 tonnes per hectare, which was 16.1% higher than CSV 18, 15.9% higher than Phule Yashoda (9.9 tonnes/ha), 16.2% higher than Phule Vasudha (9.92 tonnes/ha), 20.6 per cent higher than M 35-1(Maldandi) (9.56 tonnes/ha), 16.5 per cent higher than PKV Kranti (9.9 tonnes/ha), and 19.6% higher than Parbhani Moti (9.6 tonnes/ha). It has large, pearly white

grains and is great for creating chapattis. It is indicated for rabi agriculture on deep-black soils in western Maharashtra in irrigated areas (Annonymus, 2010).

1.3 Area, production and productivity of sorghum in the world

In the year 2018-19, developing countries accounted for more than 90% of the world's sorghum production. Sorghum is grown on 39.89 million hectares around the world, with a total production of 59.28 million metric tonnes and a productivity of 1.49 metric tonnes.

The United States currently leads the world in terms of production, with an annual output of around 9.27 million metric tonnes, followed by Nigeria (6.80 million metric tonnes), Ethiopia (5.0 million metric tonnes), Mexico (4.7 million metric tonnes). In India, the yield was 3.76 million metric tonnes.

In the year 2019-20, the world's total area under sorghum cultivation are 41.07 million hectares, with an output of 59.17 million metric tonnes and a productivity of 1.44 metric tonnes.

Table no 1.1 Area, production and productivity of sorghum in the world

Country	Area (Metric tons/ha)		Yield (Metric tons/ha)		Production (Million metric tons)	
	2018/19	**2019/20**	**2018/19**	**2019/20**	**2018/19**	**2019/20**
World	39.89	41.07	1.49	1.44	59.28	59.17
United States	2.05	1.92	4.53	4.66	9.27	8.93
Total Foreign	37.84	39.15	1.32	1.28	50.01	50.24
Africa						
Nigeria	5.80	5.90	1.17	1.17	6.80	6.90
Ethopia	1.84	1.85	2.72	2.70	5.00	5.00
Sudan	7.00	7.00	0.64	0.57	4.50	4.00
Mexico	1.35	1.50	3.48	3.33	4.70	5.00
Brazil	0.69	0.73	2.92	2.83	2.02	2.05
South Asia						
India	4.01	5.00	0.94	0.90	3.76	4.50
Pakistan	0.24	0.24	0.59	0.58	0.14	0.14
China	0.72	0.75	4.79	4.80	3.45	3.60
Australia	0.50	0.60	2.58	2.83	1.28	1.70

(Source - Foreign Agricultural Service/USDA Office of Global Analysis, 2020)

1.4 Sorghum production in India

In India, overall sorghum cultivation area declined from 7.38 million hectares in 2010-2011 to 3.84 million hectares in 2018-19, while production decreased from 7.00 million metric

tonnes to 3.76 million metric tonnes. In the 2018-19 season, the productivity increased to 979 Kg/ha.

Table 1.2 Area, production and productivity of sorghum in India

Year	Area (M. ha)	Production (M. Tonnes)	Productivity (Kg/ha)
2010-2011	7.38	7.00	949
2011-2012	6.25	5.98	957
2012-2013	6.21	5.28	850
2013-2014	5.79	5.54	956
2014-2015	6.16	5.45	884
2015-2016	6.08	4.24	697
2016-2017	5.62	4.57	812
2017-2018	5.02	4.80	956
2018-2019	3.84	3.76	979

(Source: Directorate of Economics & Statistics, DAC&FW.4th AE, 2018-19)

1.5 State wise area, production and productivity of sorghum in India (2018-19)

Karnataka, Maharashtra, Tamil Nadu, Rajasthan, Andhra Pradesh, Madhya Pradesh, and Uttar Pradesh are the primary sorghum grown states in India. During the 2018-19 fiscal year, Maharashtra ranked top in terms of area (1.40 million hectares), followed by Karnataka (0.87 million hectares) Sorghum production and productivity in Maharashtra are around 0.86 million tonnes and 617 kg/ha, respectively.

Table 1.3 State wise Area Production and Productivity of Sorghum

Sr. No.	States	Area (M. ha)	Production (M. Tons)	Productivity (Kg/ha)
1	Karnataka	0.87	0.91	1048
2	Maharashtra	1.40	0.86	617
3	Tamil Nadu	0.38	0.49	1268
4	Rajasthan	0.56	0.47	832
5	Andhra Pradesh	0.16	0.35	2266
6	Madhya Pradesh	0.14	0.31	2218
7	Uttar Pradesh	0.15	0.18	1247
8	Gujrat	0.08	0.10	1265
9	others	0.11	0.10	909
	All India	3.84	3.76	979

(Source: Directorate of Economics & Statistics, DAC&FW.4th AD, 2018-19)

Sorghum output is highest in Karnataka, at 0.91 million tonnes, and productivity is best in Andhra Pradesh, at 2266 kg per hectare.

1.6 Sorghum production in Maharashtra

Maharashtra is the leading producer of sorghum in terms of both area and production. In 2018-2019, sorghum was planted on 2.40 million hectares, yielding 1.19 metric tonnes with a productivity of 491 kg/ha.

Table no 1.4 Sorghum Production in Maharashtra

Year	Area (M. ha)	Production (M. Tonnes)	Productivity (Kg/ha)
2010-2011	4.06	3.45	850
2016-2017	3.61	2.53	702
2017-2018	3.46	2.39	690
2018-2019	2.40	1.19	491

(Source: Economic Survey in Maharashtra, 2019-20)

Solapur, Pune, Sangli, and Satara are the primary sorghum-grown districts in Maharashtra. In Maharashtra, Solapur district stands first in both output and area (1.84 lakh MT) (5.17 lakh hectare). Sangli ranks third in area (1.51 lakh ha.) and fourth in production (0.61 lakh MT), while Pune ranks second in area (1.98 lakh ha.) and sixth in production (0.61 lakh MT) (0.78 lakh MT). During the 2018-19 fiscal year, Satara ranked fourth in terms of acreage (1.49 lakh hectares) and second in terms of production (1.24 lakh MT).

1.7 Sorghum production in Solapur district of Maharashtra

Table 1.5 Sorghum Production in Solapur district

Year	Area (Hectare)	Production (Tonnes)	Productivity (Tonnes/ha)
2014-2015	622800	354100	0.57
2015-2016	615700	108000	0.18
2016-2017	658500	361780	0.55
2017-2018	656900	370080	0.74
2018-2019	513810	182500	0.36

(Source: Economic Survey in Maharashtra, 2019-20)

Table 1.5 shows data for the area, production, and productivity of sorghum in year Solapur district for the years 2014-2015 to 2018-19.

In Solapur district, the area under sorghum was at its maximum in 2016-2017, at 658500 ha, and at it has lowest in 2018-19, at 513810 ha.

According to Table 1.5, in year 2018-2019, the highest area of sorghum production was 658600 hectares, while the lowest was 513810 hectares and the highest production of 370080 tonnes was recorded, with a productivity of 0.74 tonnes per hectare. Over the course of the study, productivity ranged from 0.18 T/ha to 0.74 T/ha.

1.8 Objectives of the study

1.To study the costs and returns of M 35-1(Maldandi) and Revati cultivar of sorghum.
2.To study resource use efficiency.
3.To estimate the marketing costs, price spread and marketing efficiency of sorghum cultivar.
4.To study the problems in production and marketing of sorghum cultivar**.**

1.9 Hypotheses of the study

To fulfill the requirements of the above objectives, it was intended to test the following hypothesis

a. Null (H_o): Cultivation of Revati sorghum is not profitable than M 35-1(Maldandi) sorghum.

b. Alt (H_1): Cultivation of Revati sorghum is profitable than M 35-1(Maldandi) sorghum.

1.10 Scope utility and limitation of the study

The study's scope can be expanded to include other places with similar characteristics. However, the scope is limited to the above-mentioned goals. The study's findings will be extremely valuable in answering questions about crop profitability in the study area**.** The cultivators will subsequently be able to identify the resources required to grow this crop. Researchers, extension agents, developmental agencies, and financial institutions may find the findings are valuable in developing policies to promote the growth of this crop.

2. REVIEW OF LITERATURE

In this chapter, an attempt is made to critically review the literature of past research work done in relevance to the present study. A brief account of the previous research work done on the study is presented under the following heads.

2.1 Costs and returns of M 35-1(Maldandi) and Revati cultivar of sorghum

2.2 Resource use efficiency of Sorghum

2.3 Marketing Cost price spread and marketing efficiency of sorghum

2.4 Problems faced by growers in the production and marketing of sorghum

2.1 Cost and returns of M 35-1(Maldandi) and Revati cultivar of Sorghum

Bansode (2002) investigated the production and marketing of jowar in the Latur district, finding that the overall per hectare cost of rabi sorghum production was Rs.1592, with a B: C ratio of 1.18, i.e. Returns of Rs.1.18 from Rs.1.

Pawar *et al.* (2005) evaluated the cost and returns of rainfed and irrigated jowar in Maharashtra's Osmanabad district, and discovered that irrigated rabi sorghum production is used more paid human labour, family labour, machine labour, and fertilisers than rainfed rabi jowar production. On the other hand, on rainfed rabi sorghum, the usage of bullock labour and seed was higher than in irrigated rabi sorghum. Irrigated rabi sorghum had a net profit of Rs. 2519.17 per hectare, while rainfed rabi sorghum had a net profit of Rs. 1470.00 per hectare. In irrigated rabi sorghum fields, the output-input ratio was 1.29, while on rainfed sorghum farms, it was 1.14. In general, the cost of production per quintal on irrigated rabi sorghum farms was Rs. 680.33 and Rs. 649.92 on rainfed rabi sorghum farms.

Radha and Chowdry (2005) studied the comparative economics of seed production vis- a-vas commercial production of the cotton in Andhra Pradesh. Human labour accounts for the majority (53.86 and 19.03 per cent) of the total cost of seed production and commercial cotton production, respectively, of Rs 74412 per acre and Rs 26461 per acre. They discovered that the operational costs of all particulars were greater in seed production (Rs 68101 per acre) than in commercial production (Rs 68101 per acre) (Rs 16166 per Acre). This was owing to the additional procedures required in cotton seed manufacturing, such as gap filling, emasculation, pollination, roughing, and so on. As a result, operating costs accounted for 91% of seed production costs, compared to 61% in commercial production. It reveals that all costs in seed production were greater than in commercial manufacturing. When compared to commercial production, seed production yields positive returns with a cost-benefit ratio of (0.29:1.00). (1.00:-0.35).

Ranganath and Reddy (2005) revealed the comparative economics of seed and the non-seed production of jowar in the Kurnool district of Andhra Pradesh. They discovered that the

cost of jowar seed production agriculture (Rs 27,030.75 per hectare) was greater than non-seed rainfed farms (Rs 9,891.22) and the non-seed irrigated farms (Rs 9,891.22). (Rs 21,477.42). On jowar seed farms, the farmers produced 40.48 quintals of grain, 43.97 quintals on non-seed irrigated farms, and 19.81 quintals on non-seed rainfed farms on average.

Reddy *et al*. (2009) observed that M 35-1 dominates the post-rainy season sorghum areas in India. In terms of grain yield, 15 variations (all 13 PPB varieties and two M 35-1 bulk varieties) outperformed the popular check M 35-1 (350 g m-2) by a large margin, while two varieties (SP 18008, farmer selection, and SP 18034, breeder selection) outperformed SPV 1411 by a significant margin (480 g m-2). Among the top 15 kinds, plant heights ranged from 2.0 to 2.9 metres (M 35-1: 3.0 m and SPV 1411: 2.7 m). Time to 50% flower ranged from 74 to 82 days in 2006 (M 35-1: 82 days) and 74 to 81 days (M 35-1: 75 days) in 2007 (post-rainy season), the lodging score ranged from 1.0 to 4.3 in 2006 (M 35-1: 2.3) and 1.7 to 3.3 (M 35-1: 2.3) in 2007 (post-rainy season), and 100-grain weight ranged from 3.7 to 4.5 g in 2006 (M 35-1:)

Pouchepparadjou *et al*. (2009) observed that the comparative economics of seed production vis-a-vas commercial grain production of paddy in Pondicherry. According to the findings, the cost of cultivation is higher in seed production than in commercial rice production, but the total return is higher in seed production than in paddy commercial crop production.

Tawale *et al*. (2009) revealed the cost and return of rainfed and irrigated *rabi* jowar in Osmanabad district of Maharashtra and their result showed Irrigated rabi jowar production used more hired human labour, family human labour, machine labour, and fertilisers than rainfed rabi jowar cultivation. On the other hand, rainfed rabi jowar production used more bullock labour and seed than irrigated rabi jowar production. The irrigated rabi jowar net profit per hectare was Rs. 2519.17, whereas the rainfed rabi jowar net profit was Rs. 1470. On irrigated rabi jowar farms, the output-to-input ratio was 1.29, whereas on rainfed rabi jowar farms, it was 1.14. On an irrigated rabi jowar farm, the per quintal cost of production was Rs.680.33 and on a rainfed rabi jowar farm, was Rs.649.92.

Nayak *et al*. (2010) analysed the economics of fodder production in Dharwad district of Karnataka revealed that The cost of green fodder cultivation per hectare was Rs. 10877.70. Chemical fertiliser accounted for the most (Rs. 2437.75), accounting for 22.41 per cent of the total cost of agriculture. Interest on fixed capital accounted for Rs. 2953.60, or 27.15 per cent of the total cost of cultivation. The majority of the fixed costs, Rs. 2494.90, went towards the land rental value (22.93 per cent). Green fodder production averaged 37.5 tonnes per hectare, with an average gross return of Rs. 30,000 and net return of Rs.19,122.30. The average production of the major product, dry fodder, was 32.50 q/ha, and the output of the product, dry fodder, was 8.2 t/ha in dry fodder farming. At Cost A, Cost B, and Cost C in that order, the gross return per hectare

was Rs.19,540, with net return of Rs. 10,952.01, Rs. 8017.37, and Rs.7685.78. At Cost A, Cost B, and Cost C, the B: C ratio was 2.26, 1.69, and 1.64, respectively.

Ghodake (2011) In his study on production and marketing of dry fodder of *rabi* Sorghum in Solapur district The overall gross return from rabi sorghum is anticipated to be Rs. 32690. (per ha.). The total cost of production per hectare into same crop was determined to be high. (Rs.28300).

Kiran Kumar (2011) revealed that the economic analysis of seed and commercial cultivation of cotton and jowar in Kurnool district of Andhra Pradesh. The cost of cultivation per hectare for seed cotton, seed jowar, cotton commercial, and jowar commercial was projected to be Rs 2,07,875.76, Rs 67,594.78, Rs 65,455.29, and Rs 36,339.36, respectively, according to the study. Cotton seed and non-seed farms had a greater cost of cultivation than jowar seed and non-seed farms. Cotton seed farm's net income return was Rs 2,62,524.24 and non-seed farm's net income return was Rs 69,905.22, with net returns per rupee of investment of 1.26 and 1.03 for cotton seed farm and non-seed farm, respectively. Cotton seed farm and non-seed farm net income returns were Rs 2,62,524.24 and Rs 69,905.22 respectively, with net returns per rupee of investment of 1.26 and 1.03 for cotton seed farm and non-seed farm, respectively. Jowar seed farm and non-seed farm net income returns were Rs 58,294.71 and Rs 24,591.64 respectively, with net returns per rupee of investment of 0.89 and 0.68 for jowar seed farm and non-seed farm, respectively.

Namdas (2012) observed that economics of production and marketing of *rabi* sorghum in western Maharashtra. According to the study, the cost of producing rabi sorghum per hectare was Rs 22036.33. The study also found that the rental value of land, human labour, bullock labour, and depreciation on agricultural implements, among other things, were the key cost factors in the total cost of rabi sorghum production. The cost of ‘A' was Rs 12058, while the cost of ‘B' was Rs 18112, respectively. Rabi sorghum produces an average of 7.07 quintal per hectare of the principal crop. The total gross profit from production was Rs 25897.29. The profit at cost C was Rs 3860.96, with a benefit cost ratio of 1.18.

Sofiganova *et al. (2012)* revealed that the comparative economics analysis of wheat production using certified and uncertified seed the case of the Ovcepole region in the republic of Macedonia. They found that wheat farming productivity is 22.50 per cent higher when using certified seed than when using uncertified seed. Wheat production using certified seeds has the total production cost is 11.30 per cent greater than wheat production using uncertified seed. Wheat production with certified seeds has a 36.00% larger gross margin than wheat production with uncertified seeds. Wheat farming with certified seeds yields a net profit per hectare is 26.50 per cent greater than wheat grown with uncertified seeds.

Grover and Sanjay Kumar (2013) observe the economics of production, processing and marketing of sorghum for fodder in Punjab. The overall variable cost of sorghum was determined to be Rs.11946/ha, with human labour accounting for more than 60.00% of it. Paddy is the principal competing crop with sorghum during the kharif season, and paddy returns over variable cost are more than double those of sorghum. The total variable cost per hectare ranged from Rs. 9956 on small farms to Rs. 13,823 on medium farms, with Rs. 11946 on all farms, according to an analysis of costs and returns in fodder crop farming in the state. The discrepancy was attributed to differences in the usage of human labour, which accounted for more than 71% of the variable cost.

Pagare *et al*. (2013) revealed that cost and profitability of *rabi* jowar cultivation in the Marathwada region of Maharashtra state. The per hectare item wise cost and their proportion at cost C on the farmer's land was Rs. 15294.21. The per ha yield level for rabi jowar profitability was 15.52 quintal per ha, with a gross income of Rs.26968. It was also revealed that as the size of the farm grew, cost 'A,' cost 'B,' and cost 'C' all decreased, but the input-output ratio increased.

Kumar *et al.* (2017) studied the economics of sorghum seed production and revealed that the highest cost expenditure was incurred on harvesting and pooling of mature crop. The average total cost was Rs 49333, which accounted for 17.28% of the entire expenditure. The average total working capital per hectare was found to be Rs 19073.3 (66.82 percent of total cost) and the total variable cost was found to be Rs 19645.5 (68.82 percent of total cost). The average total cost per acre is found to be Rs 28544.1. Per hectare, the average total labour man days required is 84.64. The average total expenditure on labour is Rs 12120.28 (42.46 percent), making it the most expensive component of the entire cost. Labor costs the most in percentage terms, followed by manures, draught power, and seed costs.

Rao *et al.* (2017) revealed that economic analysis of improved *rabi* sorghum cultivars in rainfed situation in Maharashtra, India and In Maharashtra, Phule Vasudha, Phule Chitra, Phule Revati, and Phule Anuradha are four enhanced sorghum cultivars that were studied for their economic performance. Despite a 29.00% rise in cultivation expenses for improved cultivars, the study demonstrated significant increases in grain production (65.00%), stover yield (58.00%), grain value (27.00%), stover value (99.00%), and net returns (72.00 percent). Despite an increase in cultivation costs, a district-by-district review of these cultivars revealed significant gains in the measures below.

Tejashree and Umesh (2020) studied an economic analysis of Redgram seed production in the Chikkaballapura district of Karnataka, India. According to the study, BRG-1 variety seed production had a greater cost of cultivation per hectare (Rs 58,989), gross return (Rs 92,935), and net return (Rs 33,946) than BRG-2 variety seed production, with a yield of 15.4 quintals. The cost of cultivation, gross returns, and net returns were Rs 51,768, Rs 80,890, and Rs 29,122,

respectively, with a yield of 13.7 quintals. Farmers have benefited from the production of BRG-1 variety certified seed since then, which has resulted in increased yields and returns.

Ade (2021) revealed that the comparative economics of seed production vs grain production of soybean in the Washim district in Maharashtra. Human labour accounted for the majority of the total cost of Rs 57901.09 per hectare in seed production and 12.59 percent of the total cost of Rs 50747.70 per hectare in soybean grain production, according to the report. The increased demand of human labour in seed production was mostly due to operations such as rouging and gap filling. Bullock and machine labour (10.36 percent of total cost) and seed cost were the other factors included in soybean seed production (9.90 percent). With a benefit cost ratio of 1.33 for seed production and 1.12 for grain production, total gross income from seed and grain production was Rs 77056.75 and Rs 56788.37, respectively. The study also discovered that the total cost of seed production is higher than grain production.

2.2 Resource use efficiency of Sorghum

Sairam (2011) used the Cobb-Douglas production function to study resource-use efficiency in paddy seed production. He confessed that the regression coefficient of human labour, machine power, manures and fertilizers were positively significant at 5, 1 and 10 levels. It shows 1 per cent increase in human labour, machinery power, manures and fertilizers over their geometric mean levels, keeping other factors at constant would result in an increase of 0.2369, 0.2189, 0.0381, and 0.5009 per cent respectively in the yields on paddy seed farms.

Namdas (2012) studied resource use efficiency in *rabi* sorghum production. The study confessed that coefficient of multiple determination (R^2) was 0.72 indicating that 72 per cent variation in output explained by these seven independent factors under consideration. The human labour, number of irrigation were turned out to statistically significant at 1 per cent level of significance, manures and potash fertilizers at 5 per cent level of significance and nitrogen fertilizers at 10 per cent level of significance. This indicated that, one unit increase in the human labour and irrigation will result into 0.4710 and 0.2910 per cent increase in the output, respectively. The other resources like bullock labour and phosphate fertilizers were non-significant.

Sarnaik (2014) studied resource use efficiency by employing the Cobb-Douglas production function in Kharif Sorghum in Jalgaon district. The study revealed that coefficient of multiple determination (R^2) was 0.82 indicating that 82.00 per cent variation in output is explained by the available independent factors. The regression coefficient of variables nitrogen, phosphate, potash was estimated out to statistically significant at 1 per cent level of significance. This indicated that, one unit increase in the nitrogen, phosphate, potash would result into -0.03 per cent, 0.23 per cent, 0.02 per cent increase in the output respectively. The other resources like human labour, bullock labour and seeds were non-significant. In case of kharif Sorghum the

overall level, individual elasticity of production for every resource is less than unity indicating diminishing marginal returns for the individual resource.

Mohite (2017) employed the Cobb-Douglas production function in *rabi* sorghum production. Study revealed that Coefficient of multiple determinations (R^2) was 0.82 that indicated that 82 per cent variation in *rabi* sorghum. Variation in all independent factors explains production. Furthermore, the bullock labour regression coefficient was -0.04, yet it was negative and significant at the 1% level. It was calculated that a 1% increase in bullock labour over its geometric mean would result in a -0.04% drop in rabi sorghum productivity. The regression coefficient of area under rabi sorghum was clearly positive, at 0.16. Machine labour had a regression coefficient of 0.03 but it was positive and significant at the 1% level. It was calculated that a 1% increase in machine labour beyond its geometric mean would result in a 0.03 per cent drop in rabi sorghum production. The coefficient of area, human labour, and seeds all had positive but non-significant regressions. Machine and potassium were both significant and positive. Bullock labour, manure, nitrogen, and potash, on the other hand, had negative and non-significant regression coefficients.

Hamsa *et al*. (2017) studied resource use efficiency in cultivation of major food (ragi, maize and groundnut) crops in rainfed conditions in the central dry zone of Karnataka They concluded that the inputs used are human labour, bullock labour, machine labour, seed, fertilizer and farm yard manure (FYM) in rainfed ragi, the regression coefficients for bullock pair (1.27) and FYM (0.94) were positive and to statistically significant in rainfed maize, the elasticity of production of human labour was highest (1.18) followed by production co-efficient of seed (0.98) and fertilizers (0.63) the elasticity co-efficient in rainfed groundnut with respect to seeds was 0.41, while that of fertilizers was 0.71 indicating the scope for higher use of these inputs from the present level to optimize returns the ratio of MVP to MFC was differed from unity in all major crops, indicating scope for reallocation of expenditure among various resources.

Sonawane *et al*. (2017) studied that economic impact of sorghum improvement project, MPKV, Rahuri in Maharashtra. To estimate the marginal value product the regression coefficients should be positive and to statistically to significant. Thus, in this study, the regression coefficient of research expenditure of sorghum was found significant. An additional income of one rupee in sorghum research generated additional income of 6.20.

Naik *et al*. (2018) studied the resource use efficiency of Soyabean in the Belagavi district of Karnataka. The data was analysed using the Cobb-Douglas production analysis technique. Seed, FYM, human labour, bullock labour, and fertiliser were found to be over-used by farmers, whereas machine labour and plant protection chemicals were found to be underused. MVP to MFC ratios were less than one for Seed (-0.59), FYM (0.27), Human labour (0.13), Bullock labour (-0.23), and Fertilizer (-0.05), indicating that resources in the research region were over

utilized. The MVP to MFC ratios for machine labour (3.60) and PP chemicals (2.21) were both more than one, indicating that these resources are underutilised and have space for expansion.

Patel (2019) studied resource use efficiency by employing the Cobb-Douglas production function for sorghum cultivation in the Bhilwara district of Rajasthan. Her study revealed that the coefficient of multiple determination (R^2) for overall sample households was 0.63 which shows that 63 per cent of total variation in sorghum output was explained by the variables included in the linear multiple regression model. Similarly for small, medium and large farmer's category it was found to be 0.94, 0.90, and 0.89, respectively. For overall category the values of regression co-efficient of area (0.309), seed (0.338) and fertilizer (0.097) were observed as positive and significant at 5%, whereas manure (0.121), plant protection (0.041), human labour (0.061) and machine labour (0.095) were observed to be positive and to statistically non-significant at overall level. It also indicated that per unit increase in area, seed and fertilizer result in increase in sorghum output quantity by their respective coefficients values.

Mwangi *et al*. (2020) Using a multi-stage stratified sample of 259 sorghum farmers in the TharakaNithi County, Kenya, the Cobb-Douglas Stochastic Profit Frontier was used to analyse economic efficiency. The result revealed a wide range of profit efficiency between the best (0.96) and the worst (0.12) farmers, with a mean of 0.17. The actual profit was USD 164.88 ha-1 and the prospective profit was USD 969.87 ha-1, respectively. This means that sampled farmers lost about USD 804.99 ha-1 in profit, indicating that family labour and fixed capital base were the main contributors to sorghum profitability drivers of profit efficiency. Farmers with greater sorghum grown experience were able to get agricultural finance and attend trainings, according to the report, lived closer to the market and agro-dealers were likely to be more efficient

Tejashree and Umesh (2020) Studied the BRG-1 variety regression co-efficients of FYM (0.020), human labour (0.0008), and area (0.546) were to statistically significant at one per cent when using the Cobb-Douglas production function in red gram seed production. Other factors seeds (-0.054), fertiliser (0.046), and machine labour (0.008) had to statistically non-significant regression coefficients. Increases in gross returns from the geometric mean level of FYM, human labour, and area will result in 0.020, 0.0008, and 0.546 increases in gross returns from the geometric mean level, respectively. At 1%, the total regression model was shown to be significant. In the case of the BRG-2 variety, the fertiliser regression coefficient (0.05), human labour (0.410), and area (0.63) were all to statistically significant at 1%. The gross returns will increase by 0.05, 0.410, and 0.63 from their geometric mean levels if the significant variables fertiliser, human labour, and area are increased by one unit over their geometric mean levels. At 1%, the total regression model was shown to be significant.

Ade (2021) employed the Cobb-Douglas production function to study resource use efficiency in soybean seed production. Study revealed that coefficient of multiple determination

(R^2) was found to be 0.71, it shows that 71 per cent variation in output was jointly explained by the nine independent resource variables The regression coefficient of bullock labour was positive and significant at 1 per cent level of significance, plant protection charges was positive and significant at 5 per cent level of significance. The regression coefficient of machine power was positive and significant at 10 per cent level of significance. This indicates that there is scope to increases the use of these resources to increase production. However, human labour and manures was positive but not significant. The MVP / MC ratio of nitrogen, phosphorous and potassium were found to be negatively greater than unity which indicates that there is need to decrease these inputs for increasing the outputs.

2.3 Marketing channels and price spread of Sorghum cultivar

Bansode (2002) analyzed the price spread of *rabi* sorghum in Latur district and found that the producer's share in the consumer's rupee was 78.96 per cent. The share of wholesaler and retailer in consumer rupee was 3.65 and 5.84 per cent respectively. The total expenses incurred by producer, wholesaler and retailer were 11.54 per cent of the total price paid by consumer.

Chauhan and Chhabra (2005) studied on production, marketed surplus, disposal channels, margins and price-spread for maize cultivation in the Hamirpur district of Himachal Pradesh. For the year 2001-02, a multi-stage stratified selection procedure was employed to choose a sample of blocks (2), villages (10) and maize growers (120). According to a study on factors impacting marketed surplus, cost and margins in maize marketing, farm-level marketable surplus was 53.21 per cent of total production. The main channel in the marketing of maize employed by roughly 71.93 per cent of farmers, accounting for nearly 70% of the produce, was determined to be Producer -Local trader -WS/ CA -Processor/ Consumer. In this channel, the producer's share of the consumer's rupee is expected to be 78.01 per cent.

Muhammad Sajjad *et al*. (2008) undertaken of study to determine the distributive marketing margin of rice and the shares of different marketing functionaries involved in the marketing margins in Batkhela tehsil of Malakand district during the year2004.It was observed that two marketing channels (1) producer-wholesalers (Pharia) -retailer -consumer and (2) producer-beopary -wholesaler (Pharia)-retailer-consumer, involved in trading of rice in the study area, In channel I, the producer received 17.90% net margin and 41.04% gross margin. However, in channel II, it was found that the producer gained net margin 36.66% and 14.54 % gross margin. The main reason behind the reduction in net margin and gross margin was observed due to the relatively low involvement of farmer in the marketing activities**.**

Redkar (2009) studied marketing of paddy in Ratnagiri district in Maharashtra. In marketing of paddy, the main channels observed in study area were 1) Producer-Processor-Wholesaler-Retailer-Consumer,2) Producer-Commission agent-Processor-Retailer-Consumer 3) Producer-Wholesaler (A)-Processor-Wholesaler(B)-Retailer-Consumer. The producer share in

consumer rupee was highest 82.69 per cent (851). 78 in channel IV followed be 81.06 per cent (753.89_ in channel II ,80.59 per cent (741.43) in channel III and 79.79 (797.40) in channel IV further it is revealed that the involvement agent, processor, have decreased producer share in consumer rupee to considerable extent.

Tawale *et al*. (2009) revealed that study for estimation of marketing cost, marketing margin, and price spread through different channels of *rabi* jowar in Osmanabad district of Maharashtra. The study included fifteen wholesalers and fifteen retailers. The information was gathered for the 2005-06 fiscal year. In channel I (P-C), the price paid by the consumer was Rs.853.63 per quintal, with the producer's share of the consumer's rupee being 99.57 per cent and the price spread being Rs. 3.63. Consumers paid Rs.1008.08 per quintal in channel II (P-W-R-C), with the producer's share of the consumer's rupee at 79.15 per cent and a price spread of Rs.226.41 per quintal.

Deshmukh *et al*. (2010) observed that marketed surplus and price spread in the case of pearl millet in the year 2008-09 in Beed district in Maharashtra. About 96 pearl millet growers from Georai tehsil were chosen for the study. To research the cost, margin, and price spread in pearl millet marketing, primary and secondary wholesalers, as well as retailers from the Georai and Beed markets, were chosen. According to the findings, the total farm size of pearl millet was 0.62 hectares, with a production of 13.79 quintals. Consumers paid the highest price of Rs.920 per quintal in Channel-III, where the producers' share of the consumer's rupee was 66.21 per cent. The price paid by the consumer in Channel-II was Rs.775 per quintal, with the producer's hare in consumer's rupee being (77.80%), but the price paid by the consumer in Channel-I (Producer-consumer) was less than in Channel-II and Channel-III. In comparison to Channel-11 and Channel-III, the producer's share of the consumer's rupee was greatest at Rs.599.00 per quintal, or 97.66 per cent. Producers obtained the highest net price in Channel-III, which was Rs.610.00 per quintal, compared to Channel-II (Rs.603.00 per quintal) and Channel-I (Rs.603.00 per quintal) (Rs.585 per quintal). Similarly, the biggest price spread was Rs.311.28 in Channel-III, followed by Rs.172.00 in Channel-II, and Rs.14.00 in Channel-I. The Channel-III was shown to be helpful to both producers and intermediaries.

Barkade *et al.* (2011) worked on economics of Onion cultivation and its marketing pattern in the Satara district in Maharashtra and observed that producers share in consumers rupee was 78.68% by selling fresh onion. The wholesalers and retailers were taking away the major share of 05.37% and 8.76% of consumer’s price without investing any penny in the marketing process for the marketing of Onion the important channel were identified(1)Producer-Consumer(2)Producer-Wholesaler-Consumer,(3)Producer-Wholesaler-Retailer-Consumer.

Navadkar *et al*. (2012) revealed that marketing cost, market margin and price spread of maize in the Ahmednagar district in Maharashtra state. The marketing cost paid during the sale

of maize in Channel-I was calculated to be Rs. 203.28 per quintal at the overall level, according to the result. Commission charges accounted for 50.66 per cent of marketing costs, followed by packing charges (25.27 per cent) and transportation costs (19.68 per cent). The marketing cost incurred during the selling of maize in Channel II was calculated to be Rs. 47.50. Packing (84.63 per cent) and shipping charges were the two most significant components of marketing costs (10.74 per cent). In the Karjat and Ahmednagar markets, the producer's share of the consumer's rupee was 78.26% and 73.19%, respectively.

Hile *et al*. (2013) conducted that the economics of production and marketing of *rabi* sorghum in western Maharashtra. The result revealed that marketing costs such as commission, transportation, and packaging charges were the most crucial, accounting for 59.35 percent, 29.39 percent, and 5.88 percent of total marketing costs, respectively. The rabi sorghum marketing price spread was Rs. 524.44, and the net price received by the.

Sharma *et al*. (2013) observed that the study on marketing efficiency and price spread of pearl millet in Rajasthan. The districts of Jodhpur and Nagpur were chosen for the purpose of examining marketing costs and margins obtained by various intermediaries in the selling of pearl millet. The data on marketed excess, price received, and marketing costs was gathered, and the price dispersion across different value chains was evaluated. The producer's share of the consumer rupee was largest in Channel II, followed by Channel I, and lowest in Channel III in most countries.

Rao *et al*. (2017) found that the average cost of cultivation, Cost C2 of the improved sorghum was about Rs 28000 per hectare whereas that of Local hovered at Rs 23000 per hectare with a difference of 23 % higher than the operational cost was 37 % higher in the case of the improved cultivars over the local check. However the same trend was followed in terms of added gross profit from the improved cultivars. The gross returns and the net returns were 32 % and 42 % more than the local check respectively.

Vikas Kumar *et al*. (2017) worked on an economic analysis of sorghum seed production. The most expensive part of the process was harvesting and pooling the mature crop. The average total cost of that was 4933.3, or 17.28% of the overall cost. The average total working capital per acre was found to be Rs.19073.3 (66.82 per cent of total cost) and the total variable cost was found to be Rs 19645.5 (68.82 per cent of total cost). The average total cost per acre is found to be Rs 28544.1. Per hectare, the average total labour man days required is 84.64. The average total expenditure on labour is Rs. 12120.28 (42.46 per cent), making it the most expensive component of the entire cost. Labour costs the most money in percentage terms, followed by manures, draught power, and seed costs. The average quality seed yield per hectare was 857.00 kilogramme. The average price per kilogramme of good seed was Rs 35. The total yield per hectare was found to be Rs 51899.41. The average net return per acre is Rs 22161.33. The

average benefit-to-cost ratio is calculated to be 1.72. When just primary product quality seed was evaluated for sale, the cost of seed production was Rs 35.11 per kilogramme of seed.

2.4 Problem faced by farmers in Production and Marketing

Bansode (2002) worked on the problems faced by farmers in production and marketing of sorghum in Latur district and revealed that non availability of hired human labour (60.83 per cent) high cost of fertilizer (59.67 per cent) non availability of seed in time, (52.20) and non-availability of loan in time (50.83 per cent) were the major constraints. The major marketing problems faced by farmer were high transportation cost (75.00 per cent) and high commission charges (67.50 per cent).

Basavaraj and Kunnal (2002) identified the constraints in production, marketing and processing of soybean in Belgaum district. It was observed that severe problems faced by growers were rust disease leading to heavy loss, high labour wages and non-availability of quality seeds in the production front. In marketing, farmers experienced problem of price fluctuation, low price for the produce, problem of transportation and delayed payment of sale when produce was sold to cooperative society. The other problems were inadequate power supply and non-availability of labour at critical times faced by the processor.

Tanveer (2006) conducted a study to know the constraints faced by the paddy growers in Mandya district of Karnataka. He opined that major constraints as expressed by the farmer respondents in the study area were high cost of inputs, fluctuation in the prices of the produce, shortage of organic manures/FYM, lack of transportation, marketing facilities and scarcity of funds.

Khan (2007) studied the problems in production of soybean .The study was conducted on 50 farmers of Narsing kheda village in Sihore district. Severe constraints like the unavailability of electricity, higher input cost, limited resource of information and unavailability of insecticides, pesticides and fertilizers increases the cost of cultivation and check their income. Socio-personal attributes like age, land holding and economic motivation had positive and significant correlation, while education, scientific orientation and risk preferences had negative and non-significant correlation.

Naik (2007) conducted a study on production and marketing of underutilized millets in northern Karnataka. The study revealed that non- availability of processing units was the very serious impediment in the study area as reported by 93.33 per cent of the farmers. The availability of storage and transportation facilities were inadequate. Further it was revealed that market information was inadequate for 66.67 per cent of the farmers. He concluded that there is need to establish processing and storage facility in the vicinity of the farmers and also there is need to establish the Agricultural Market Extension Service for educating the farmers about how to access, use and take benefit out of the available market information.

Chahal, S. S. Poonam Kataria. (2010) The findings of the study revealed that the selected maize growers faced constraints as maize crop specific technology adoption was concerned. The lack of finance, insufficient marketing facilities, lack of storage facilities, non-availability of seed suitable for local needs, late sowing of crop, and other institutional, marketing, and socio-economic constraints were identified to be barriers in maize production. The extensive investigation of the impediments to maize production and marketing reveals the urgent need for a complete revamp of the marketing system. In a state like Punjab, where ground water is rapidly disappearing, this healthy allocation of resources to maize crop needs to be varied in favour of less water-demanding crops like maize.

Nayak *et al*. (2010) studied the constraints in production and marketing management of fodder crops in Karnataka and reported that the high cost of labour (80.00%), non-availability of labour during peak season (71.00%), insufficient availability of water (62.00%), non-availability of quality seeds (40.00%) and high cost of chemical fertilizers were the major constraints in production of fodder. The major problems faced by framers were high transportation cost (100.00%) and lack of storage facilities (93.00%), lack of market facilities (88.90%), limited buyers in the market (84.50%). Mistakes in weighing (80.00 per cent), low prices offered by buyers (73.00 per cent), non-availability of transport vehicle (64.50 per cent), excessive commission costs (38.00 per cent), and hefty market fee were the other marketing issues (36.00 per cent).

Ghodke (2011) studied on constrains in production and marketing of *rabi* sorghum. Study revealed that the high wage rates was major problem which accounted by 73.33 per cent of the farmers. Nearly 70 per cent farmers complained about the non-availability of labour. Technical knowledge about *rabi* sorghum cultivation was lacking in 45.55 per cent farmers, 41.11 per cent farmers complained about the non-availability of inputs in time while 25.55 per cent farmers had complained about difficulty in transportation of dry fodder. The problems of the high fertilizer cost were mentioned by 66.66 per cent farmers. The 55.66 per cent farmers had problems about the non-availability of credit on time.

Kusuma (2011) conducted research under the title Production and value addition in foxtail millet in Bellary district – an economic analysis. The opinion of sample farmers about the problems in foxtail millet production indicated that the sample farmers were satisfied with the availability of finance and technical guidance for the crop production. About 44.44 per cent of farmers were of the opinion that labour availability was adequate and 55.56 per cent farmers complained about the non-availability of labour. This was because of heavy demand for labour during peak seasons of sowing and harvesting. Farmers also opined that availability of high yielding varieties was inadequate (83.33%). About 61.11 per cent of the sample farmers were unaware of the value addition. The state departments of agriculture and agriculture universities

have pivotal role in educating the farmers regarding value addition and latest technology. Finally, non- availability of the quality seeds was one of the major problem in the production of foxtail millet. The state and national seed corporations have to concentrate on the production of quality seeds of these minor millets as the private seed companies are not taking up seed production of these crops.

Patil. *et al.* (2014) Post-rainy (rabi) sorghum grows in semi-arid regions of India under residual soil moisture conditions and is crucial for food and fodder security, particularly during dry seasons. Unlike rainy sorghum, where hybrids are dominant, post-rainy sorghum grown areas are dominated by varieties, particularly landrace selections. M 35-1, a landrace selection produces seven and a half decades ago, covers much of the area. After the rainy season, post-rainy sorghum research was not prioritised until the 1990s, and the varieties and hybrids developed and released could not compete with M 35-1 in yield or quality. With the recent production of cultivars for specific soil depths, including as shallow, medium, and deep soils, some improvement has been made.

Tawale and Pawar (2011) studied the problems in production of soybean in Maharashtra. Constraints such as insect pests and illnesses were expressed by 74.45% of soybean growers, according to the findings. Soybean growers faced considerable challenges due to a lack of labour at harvest time (62.78%) and a low price of soybean at harvest time (61.11%). Suggestions include the supply of pest and disease control training, which was suggested by 61.11 per cent of farmers, and the offer of a high rate for soybeans, which was supported by 53.89 per cent of farmers.

Namdas (2012) studied problems faced by farmers in *rabi* sorghum production. According to the study, high pay rates are a major constraint, as noted by 72.22 per cent of farmers. 58.89 per cent of farmers expressed concern over excessive fertiliser costs. Nearly 55.50 per cent of farmers expressed dissatisfaction with labour shortages. 44.44 per cent of farmers lacked technical understanding on rabi 70 sorghum farming. Farmers have complained about the quality of their produce in 53.33 per cent of cases, and 44.44 per cent have complained about the inability to obtain bank credit on time in 44.44 per cent of cases. About 41.11 per cent of farmers had difficulties obtaining input in time, while 40.00 per cent had difficulty transporting rabi sorghum.

Sattigeri (2014) conducted research on economic of *rabi* sorghum and its competitive crops in Belgaum district of Karnataka. The study concluded that the unavailability of labour during peak period was the major problem ranked I which recorded mean score of 73.80, followed by non-availability of quality seed material, incidence of pest and diseases, the unavailability of fertilizers and non-availability of PPC which were ranked II, III, IV and V with mean scores of 62.00, 53.60, 52.40 and 44.00 respectively.

Raut (2016) studied constraints in production of *rabi* sorghum in Solapur district the Maharashtra. The result confessed that out of 96 total respondent 37.05 respondent reported problem about inadequate and untimely rainfall. This problem occupied first rank and second major problem was inadequate transportation facilities (second rank) 33.34 per cent followed by 31.25 per cent of farmers expressed as lack of market information, 30.20 per cent of farmers faced problem as non-availability of fertilizer in time, high labour machine charges for *rabi* jowar as 29.16 per cent and some other minor problems found but important like inadequate irrigation facilities (26.04 per cent), high rate of input (22.97 per cent), non-availability of labour at time of harvesting (28.83), lack of information about seed treatment (18.75 per cent).

Keerti Sahu (2017) conducted study on economic analysis of paddy in Raipur district of Chhattisgarh. The study reveals the constraints faced by major paddy growers in the study area. Study shows the lack of labour was the most important problem as reported by 45% per cent paddy production. The second most important constraint faced by the paddy growers was Low adoption of recommended package and practices of crop (20 %). The other most important constraints reported by the paddy growers were lack of literacy (16 per cent), time factor (16 per cent), lack of knowledge (20 per cent) and lack of guidance (8 per cent) .According to result there is a need to impart training skills to the paddy grower on production aspect through extension support such as on farm training, demonstration etc.

Ade (2021) studied the problems faced by farmers of seed production vs, grain production of soybean in the Washim district the Maharashtra. The study conclude that Out of 45 soybean seed growers labour scarcity at peak season ranked as first by 21 respondents, second rank by 19 respondents, third rank by 2 respondents. Similarly risk of rejection of soybean seed at the time of grading, processing and testing ranked as first by 18 respondent, second ranked by 19 respondents, third ranked by 5 respondents. The labour scarcity at peak season got the first rank, followed by risk of rejection of soybean seed at the time of grading, processing and testing, high wages rates, high cost of foundation seed, maintenance of seed plot required more labour, lack of availability of good quality seed, lack of technical knowledge.

3. METHODOLOGY

A. Methodology

The aim of any specific investigation is to draw the useful conclusions in the light of objectives of the study. In order to arrive at the meaningful conclusions it is essential for investigator to adopt appropriate methods and procedures. Keeping this in view, this chapter has been devoted to explain the methodology adopted to fulfill the objectives under study. It deals with the procedures adopted for the selection of samples, method of data collection, type of data collected, sources of data, analytical procedures used to get the result as per the objectives of the study.

3.1 Data requirements

In order to study the production and marketing aspects of rabi sorghum in Solapur district, the data on various aspects as indicated below were collected.

- ❖ General information regarding the sample rabi sorghum growers.
- ❖ The data on cost of cultivation of rabi sorghum.
- ❖ The information of marketing channels and practices followed, functionaries involved in marketing of rabi sorghum.
- ❖ The data regarding the arrivals and prices of rabi sorghum.

3.2 Selection of the study area

Solapur district is one of the district grown sorghum crop in Maharashtra. Therefore, Solapur district was selected purposively for the present study on the basis of area. Secondly, two Tehsil *viz*. Mangalwedha and Barshi were selected purposively as area under Sorghum was higher in two tehsil *viz*. Mangalwedha and Barshi. The three villages from each tehsil were selected on the basis of list of M 35-1(Maldandi) and Revati growers. From Mangalwedha Tehsil Borale, Mundhewadi and Mangalwedha and from Barshi Tehsil Vairag, Soundare and Mandegaon.

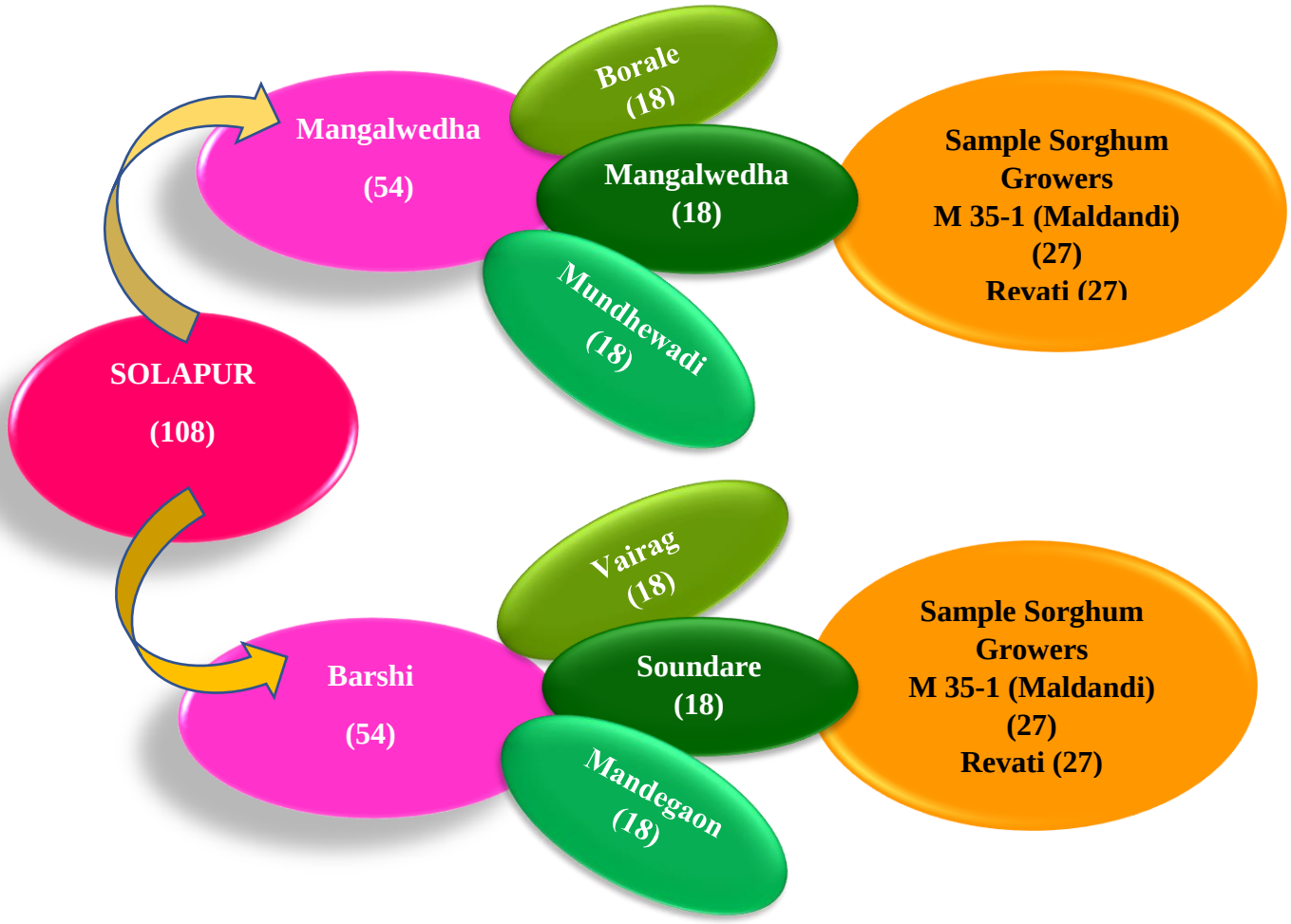
3.3 Sampling Technique

Three villages from each tehsil were selected purposively for study on the basis of area under M 35-1(Maldandi) and Revati sorghum cultivation. The list of M 35-1(Maldandi) and Revati growers along with their operational area and area under M 35-1(Maldandi) and Revati cultivation for each of the selected villages was prepared on the basis of information obtained from village revenue office. The M 35-1(Maldandi) and Revati growers were arranged in descending order of their area under cultivation for each of the selected villages and three growers from each of the three predetermined size classes (i.e. area under M 35-1(Maldandi) and Revati cultivation) *viz.,* Group I (up to 0.40ha), Group II (0.41 to 0.80ha) and Group III (0.81ha and above) thereby making a total of 18 growers from each village were selected randomly. From each village nine M 35-1(Maldandi) growers and nine Revati growers were selected as

sample sorghum growers. Thus, the total sample size for the study will consists of 108 sorghum growers comprising 36 for each size group.

Table no 3.1 Group wise Distribution of Selected *Rabi* Sorghum farmers

Sr.No	Area	Mangalwedha Tehsil	Barshi Tehsil	Total Growers
1	Up to 0.40 ha	18	18	36
2	0.41-0.80 ha	18	18	36
3	0.81 ha and above	18	18	36
	Total	54	54	108



3.4 Sampling Design

The sampling design adopted for the investigation was two stage purposive sampling with sample tehsil as a primary unit of sampling and village as a secondary unit of sampling. The sorghum growers were selected randomly.

3.5 Data Collection

The data were collected by survey method conducting personal interviews using specially designed questionnaire for the study purpose. The information was collected regarding the aspects like land use pattern, cropping pattern, input utilization and yield for sorghum crop during the year 2019-20. The information pertaining to marketing of sorghum *viz*. marketing cost, price realized and marketing channel followed was collected from sorghum growers and market functionaries.

3.6 Analysis of Data

Analysis of the data on physical resource use in *rabi* sorghum cultivation *viz,* seed, male labour, female labour, bullock labour, manures, fertilizers, irrigations and plant protection etc., was carried out by tabular analysis.

3.7 Analytical Techniques

3.7.1 Cost concept

The first objective of the study on cost and returns in Sorghum production was completed by analysing the data using standard cost concepts generally followed in farm management studies i.e. cost-A, cost-B and cost-C with the help of tabular analysis**.**

Cost A

It included the cost on account of hired human labour, bullock labour (hired and owned), seeds (home produces and purchased), manures (owned and purchased), fertilizers, plant protection measures, machinery charges, land revenue and other casses, interest on working capital, depreciation on implements and machinery, repairs of machineries and irrigation charges etc.

Cost B

Rental value of owned land and interest on fixed capital represent the imputed cost which is added to the Cost ‘A’. Thus,

Cost ‘B’ = Cost ‘A’ + Rental value of land + Interest on fixed capital.

Cost C

It was the total cost of production, which included all the costs items (actual as well as imputed). The imputed value of family labours were added to cost ‘B’ to work out cost ‘C’. Thus,

Cost ‘C’ = Cost ‘B’ + Imputed value of family labour.

3.7.2 Functional analysis

The data were further analyzed by making the use of different mathematical models (at least three) such as Translog, Linear, nonlinear i.e. the Cobb-Douglas production function and the result of best suitable model will be presented for estimating resource use efficiencies.

A) The Cobb-Douglas production function of the following type were used.

$$Y = a\ X_1^{b1}\ X_2^{b2}\ X_3^{b3}\ X_4^{b4}\ X_5^{b5}\ X_6^{b6}\ X_7^{b7}\ X_8^{b8} X_9^{b9}.\ e^{u}$$

When expressed in logarithmic terms this functiontransfer into linear function of the following types,

$$\text{Log } Y = \text{Log } a + b_1 \text{ Log } X_1 + b_2 \text{ log } X_2 + \ldots\ldots + bn \text{ Log } Xn + u \text{ Log } e$$

Where,

Y= Dependent variable (Output) in Tones

X_1= Seed (kg/ha)

X_2= Male Labour (days/ha)

X_3= Female Labour (days/ha)

X_4= Manures (q/ha)

X_5= N (kg/ha)

X_6= P (kg/ha)

X_7= K (kg/ha)

X_8= Irrigation charges (Rs.)

X_9=Plant protection measures (Rs.)

bi's = Regression coefficients of production of respective factors

a = Constant.

e^u= error term

3.7.3 Specification of Variables

A brief description of the inputs used as explanatory variables for the individual crop enterprise in present study has been explained in succeeding paragraphs.

i) Seed (X_1)

Sorghum is propagated by Seed. Seed input has been expressed in terms of kilogram per hectare.

ii) Male labour (X_2)

Male labour expressed in terms of man days of eight hours. It includes all human labour utilized for performing different farm operations right from preparation of land to harvesting

iii) Female labour (X_3)

Like male labour, female labour was expressed in terms of man days of eight hours. Mostly female labour was required for weeding operation.

vi) Manures (X_4)

Manures were considered in quintals.

vii) Nitrogen (X_5)

The nitrogen contained in straight and mixed fertilizer was calculated by applying proper formula. It was quantified in kilogram.

viii) Phosphorus (X_6)

Same way the P_20_5 contained in fertilizers was calculated and taken in kilogram.

ix) Potash (X_7)

The potash contained in fertilizers was calculated and taken in kilogram.

x) Irrigation (X_8)

The actual charges incurred for irrigation by the cultivators for *rabi* sorghum were considered.

xi) Plant protection (X_9)

The actual charges incurred for plant protection by the cultivators for *rabi* sorghum were considered.

x) Output (Y)

The output was used as a dependent variable for *rabi* sorghum. Main produce and By-produce were the output in q/ha.

3.7.4 Estimation of Resource Use Efficiency

The resource use efficiency was judged on the basis of the ratio of marginal value products of the resources to its factor price ratio as under:

MVP/MFC =1 (Optimum use of resources)

MVP/MFC <1 (Excess use of resources)

MVP/MFC >1 (Underutilization of resources)

3.7.4.1 Marginal Value Product

The marginal value of products (MVPs) of the individual resources were estimated and compared with the marginal cost (MC). The following formula was used to calculate the MVP of individual resources:

$$\text{MVP} = b_i \frac{\overline{Y}}{\overline{X}} p_y$$

Where,

b_i= Elasticity of production corresponding to the i^{th} input

X = Geometric mean of particular independent variable.

Y = Geometric mean of dependent variable.

P_y= Price of output.

3.8.4 Total Marketing Cost

$$C = C_f + C_{m1} + C_{m2} \ldots\ldots\ldots\ldots C_{mi}$$

Where,

C = Total marketing cost.

C_f= Cost paid by the producer from the time of produce leaves the farm till he sells it.

C_{mi}= Cost incurred by i^{th} middleman in the process of buying and selling the product.

3.8.5 Price spread

Price spread: Consumer's price - Price received by farmer

$$P_s = C_p - P_f$$

Where,

P_s = Price spread

C_p= Consumer's price

P_f= Price received by farmer

3.8.6 Marketing margin

$$MT=\Sigma (S_i - P_i)/Q_i$$

Where,

MT = Total Marketing Margin

Si = Sale value of a product paid by i^{th} firm

Pi = Purchase value of a product paid by i^{th} firm

Qi = Quantity of product handled by i^{th} firm

3.8.7 Marketing efficiency

The marketing efficiency were calculated by using the modified method as suggested by Acharya and Agarwal (1999).

MME = RP/ (MC+ MM)

Where,

MME = Modified measure of marketing efficiency.

RP = Price paid by consumer or retailer's sale price.

MC = Total marketing cost

MM = Net marketing margin.

3.8.8 Problems in production & marketing of Sorghum

There was a debate about whether the number of responses to a particular priority should be prioritised over the largest number of responses to a constraint in the first priority when quantifying the constraints expressed by farmers. However, they arrive to different conclusions. To solve this, a Responses-Priority Index (RPI) was created as a product of Proportion of Responses (PR) and Priority Estimate (PE), where PR for each constraint gave the ratio of the number of responses for that constraint to the total responses, as calculated by the equation given by (I.V.Y. Rama Rao 2011)

$$(RPI)_I = \frac{\sum_{j=1}^{k} f_{ij} \cdot X_{[(k+1)-j]}}{\sum_{i=1}^{1} \sum_{j=1}^{k} f_{ij}} \quad (0 \leq RPI \leq 5)$$

where,

$(RPI)_I$= Response Priority Index for i^{th}constraint,

f_{ij} = Number of responses for the j^{th}priority of the i^{th} constraints. (i=1, 2……, l; j= 1,2,3…..k),

$\sum_{j=1}^{k} fij$ = Total number of responses for the i^{th} constraint.

$X_{[(k+1)-j]}$ = Scores for the j^{th} priority,

k = Number of priorities, i.e. 5,

$\sum_{i=1}^{1} \sum_{j=1}^{k} fij$ = Total number of responses to all constraints, and

$\sum_{i=1}^{1} (RPI)_I$= Summation of RPI indices for all constraints.

B. Profile Study of Area

3.9 General information of the study area

Agricultural productivity is largely influenced by local soil and climatic circumstances, such as soil type, temperature, and rainfall. Humans can't manage natural resources since they're too valuable. Crops to be grown and farm economy are also influenced by marketing arrangements and the availability of sufficient and timely loans at lower rates. It was thought important to explain briefly the salient aspects of the area under research in order to gain a better knowledge of the physical features and agricultural pattern in the area under examination (Anonymous, 2020).

3.10 Location

Solapur is situated between the latitudes of 17.10 and 18.32 degrees north and the longitudes of 74.42 and 76.15 degrees east. The district is located in the state's southern outskirts, entirely within the Bhima and Seena basins. The Bhima River and its tributaries drain the entire district. On the north, Ahmednagar and Osmanabad districts border the district; on the east, Osmanabad and Gulbarga (Karnataka State) districts border the district; on the south, Sangli and Bijapur (Karnataka State) districts border the district; and on the west, Satara and Pune districts border the district.

The district lacks a significant hill system. Several spurs of the Balaghat range pass south for a few kilometres only in the north of Barshi Taluka. In the Talukas of Karmala, Madha, and

Malshiras, there are a few scattered hills. The landscape in the district is mostly flat or undulating. The low table land and small separate hills in Karmala and Madha Talukas act as a watershed between Bhima and Sina rivers The district spans 14844.6 square kilometres, accounting for 4.82 per cent in Maharashtra's total land area. The district's total size is 338.8 square kilometres (2.28 per cent), with the remainder 14505.8 square kilometres (97.72 per cent) being rural. (Anonymous, 2020)

3.11 Soil

Due to its geographical location, Solapur district contains a diverse range of soils. Solapur district's soil is volcanic in origin. The geological foundation of soils in Solapur district comes mostly from the Deccan trap, which is volcanic in origin and is known as "basalt."

The soils are eroded to varied degrees and have a truncated profile. Soils are typically clay in texture, with montmorillenite clay being the dominating mineral. Because of the clay minerals in the soil, it swells and shrinks when wet and dries, resulting in fissures after a rainy season. The soils have a low total nitrogen content, a low to medium amount of available phosphorus, and a high amount of available potassium. The soils in the district may be classed mostly by depth, with medium deep soils (22.5 to 90 cm) accounting for 45 per cent of the land and deep soils of more than 90 cm accounting for 25 per cent. About 30 per cent of the area is under shallow soils. (Anonymous, 2018)

3.12 Climate and rainfall

1) The cold weather season: (December to February)

2) The hot weather season: (March to May)

3) The southwest Monsoon season: (June to August)

4) The post Monsoon season: (September to November)

Table no 3.2 Normal Rainfall from various Station in Solapur Districts

Sr.no	**Tehsil**	**Avg.**	**2015**	**2016**	**2017**
1	N. Solapur	410.2	271.98	547.94	410.68
2	S. Solapur	405.72	228.17	534.86	454.13
3	Akkalkot	361.05	246.86	456.67	379.62
4	**Barshi**	**533.91**	**238.58**	**593.68**	**769.47**
5	Pandharpur	388.23	278.33	375.01	511.36
6	**Mangalwedha**	**234.72**	**227.46**	**30.04**	**446.68**

(Source- https://solapur.gov.in/en/rainfall/)

The average annual rainfall in the district is around 584.3 mm. Drought areas in the eastern, southern, south eastern, the central, and north western parts of the district, including

Akkalkot, South Solapur, Karmala, Madha, some parts of Mangalwedha, and Sangola, cover 60-80 per cent of the district. (District Survey Report)

3.13 Population of Solapur 2021

Solapur is a city located in the south-western region in Maharashtra, India. It is the 5th biggest city in Maharashtra and the 49th most populous city in India and 43rd largest urban agglomeration.

3.13.1 Solapur Population - Census 2011

According to Census India's provisional data, the population of Solapur City in 2011 was 9,51,558 (9.51 lakhs), with a male population of 4,81064 and a female population of 4,70,494. (Anonymous,2011)

3.13.2 Literacy Rate

In 2011, the average literacy rate in Solapur City was 82.80%. When looking at things from a gender perspective, male and female literacy rates were 89.62 per cent and 75.88 per cent, respectively. Solapur's total literate population was 6,97,327, with 3,80,64 men and 3,17,263 females. (Anonymous,2011)

3.13.3 Density

According to preliminary census India 2011 data, the population density of Solapur in 2011 was 5300 persons per square kilometre. The city of Solapur covers an area of 180 square kilometres.

3.13.4 Child Population

Data on children aged 0 to 6 were also obtained during the census enumeration. A total of 1,09,360 children aged 0 to 6 years were counted. There are 57,001 boys and 52,359 girls in all. According to the 2011 census, the child sex ratio was 919. In 2011, children aged 0 to 6 made up 11.49 per cent of Solapur City's total population. (Anonymous,2011)

3.14 Pattern of agriculture in study area

3.14.1 Land utilization pattern

Between 2003-04 and 2017-18, the area under barren and uncultivable land increased from 4.23 per cent to 4.87 per cent. The change in percentage was 15.08 per cent. Non-agricultural land expanded from 150.00 to 160.00 hectares between 2003-04 and 2017-18, corresponding to 1.0 to 1.07 per cent of total geographical area and a 6.67 per cent growth. During the same time period, the land under cultivable waste increased by 2.28 to 2.60 per cent, from 340.00 to 387.00 hectares. The change in percentage was 13.82 per cent.

Table 3.3 Land Utilization Pattern of Solapur District

Sr no	Particulars	2003-2004	2017-2018	% Change
1	Geographical Area	14878 (100)	14878 (100)	00
2	Forest	320 (2.15)	353 (2.37)	10.31
3	Barren and uncultivable land	630 (4.23)	725 (4.87)	15.08
4	Land under non-agricultural use	150 (1.0)	160 (1.07)	6.67
5	Cultivable cost	340 (2.28)	387 (2.60)	13.82
6	Permanent pasture	380 (2.55)	459 (3.08)	20.79
7	Land under miscellaneous tree	50 (0.33)	71 (0.47)	42.00
8	Current fallow	1930 (12.97)	1111 (8.03)	-42.44
9	Other fallow	1900 (12.77)	1196 (8.03)	-37.05
10	Net sown area	9184 (61.72)	10416 (70.00)	13.41
11	Area sown more than once	376 (2.52)	2028 (13.63)	439.36
12	Gross cropped area	9560 (64.25)	12444 (83.64)	30.17
13	Cropping intensity	108.1	119	10.08

Source - (*Journal of Pharmacognosy and Phytochemistry 2020*)

Between 2003-04 and 2017-18, the entire geographical area stayed steady at 1487800 hectares. In 2003-04, the area under the forest was 320.00 hectares, or 2.15 per cent of the total geographical area; in 2017-18, it climbed to 353.00 hectares, or 2.37 per cent, and the per cent change was 10.31 per cent.

3.15 Cropping Pattern

The types of major crops were grown under proportion of area under food grains, cash crops to influence agricultural economy of district. Average of area under different crops were worked out and cropping pattern for two periods are presented. Area under Rice crop was increased from 2.00 hectares to 6.00 hectares during period 2003-04 to 2017-18.

Between 2003-04 and 2017-18, the area under Jowar rose from 6141.00 to 6569.00 hectares. The change in percentage was 6.96 per cent. From 2003-04 to 2017-18, the area under Bajara expanded from 1.01 to 2.29 per cent, from 97.00 to 286.00 hectares.

Between 2003-4 and 2017-19, the area under wheat and maize combined crops increased from 308,148 to 687,758 hectares. Between 2003-04 and 2017-18, the area under total cereals grew from 6724.00 to 8323.00 hectares. The change in percentage was 23.78 per cent.

Table no 3.4 Changes in the cropping pattern of Solapur (2003-04 to 2017-18)

(Area in "00"ha)

Sr.No.	Particulars	2003-2004	2016-2017	Percentage Change
1	Rice	2(0.02)	6(0.04)	200.0
2	Jowar	6141(64.23)	6569(52.78)	6.96
3	Bajara	97(1.01)	286(2.29)	194.85
4	Wheat	308(3.22)	687(5.52)	123.05
5	Maize	148(1.54)	758(6.09)	412.16
6	Other cereals	28(0.29)	18(0.14)	-35.71
7	Total Cereals	6724(70.33)	8323(66.88)	23.78
8	Red gram	77(0.80)	298(2.39)	287.01
9	Green gram	13(0.13)	126(1.01)	869.23
10	Black gram	23(0.24)	216(1.73)	839.13
11	Gram	280(2.92)	682(5.48)	143.57
12	Other pulses	17(0.17)	26(0.20)	52.94
13	Total Pulses	410(4.28)	1351(10.85)	229.51
14	Groundnut	21(0.21)	51(0.40)	900.00
15	Sesamum	1(0.01	4(0.03)	300.00
16	Nigerseed	1(0.01	1	0.00
17	Sunflower	216(2.25)	210(1.68)	-2.78
18	Soybean	6(0.06	335(2.69)	5483.33
19	Safflower	216(2.25)	8(0.06)	-93.98
20	Linseed	3(0.03)	0.8	-73.33
21	Total Oilseed	382(3.99)	614(4.93)	60.73
22	Cotton	11(0.11)	3(0.02)	-73.23
23	Sugarcane	486(5.08)	1005.1(8.07)	106.80
24	Total Food grains	7134(74.62)	9634(77.41)	35.04
25	Gross Cropped Area	9560	12444	30.17

Source - (*Journal of Pharmacognosy and Phytochemistry 2020*)

Changes in cropping Pattern

The area under Red Gram was expanded from 77.00 to 298.00 hectares, representing 0.80 and 2.39 per cent of the total planted area, respectively. The change in percentage was 287.01%. In 2003-04, the area under Green Gram was 13.00 hectares. During the 2017-18 fiscal year, it was increased to 126.00 hectares. During the period 2003-04 to 2017-18, the area under the Gram rose by 2.92 to 5.48 per cent, from 280.00 to 682.00 hectares. Between 2003-04 and 2017-18, the total pulses area expanded from 410.00 ha to 1351.00 ha, a 4.28 to 10.85 per cent growth.

The change in percentage was 229.51%. From 2003-04 to 2017-18, the area under groundnut was expanded from 21.00 hectares to 51.00 hectares. During the period 2003-04 to 2017-18, the area under sunflowers declined from 216.00 to 210.00 hectares, or 2.25 to 1.68 per cent of gross cropped area. The change in percentage was -2.78 per cent. During the same time span, the area under Safflower and Linseed also decreased. From 2003-04 to 2017-18, the total area under Oilseed increased by 3.99 to 4.93 per cent, from 382.00 to 614.00 hectares. During the years 2003-04 to 2017-18, the area under cotton was reduced from 11.00 to 3.00 hectares.

The change in percentage was -73.23 per cent. Between 2003-04 and 2017-18, the area under sugarcane expanded dramatically, from 486.00 to 1005.10 hectares, or 5.08 to 8.07 per cent of gross cropped area. Total food grain area has also increased from 74.62 per cent to 77.41 per cent of gross cultivated area.

4. RESULT AND DISCCUSSION

This study is conducted in Solapur district in Maharashtra. The necessary data were collected from the sample farmers spread over two tahsils of the above-mentioned district. The data were subjected to various statistical tools to draw meaningful conclusions. The interpretation and discussion are based on the findings of study. The presentation of result provides clear picture about the research findings. The main result of the study are presented in this chapter under the following heads.

1. To study the costs and returns of M 35-1(Maldandi) and Revati cultivar of sorghum.
2. To study the resource use efficiency.
3. To estimate the marketing costs, price spread and marketing efficiency of sorghum cultivar.
4. To study the problems in production and marketing of sorghum cultivar.

4.1 Socio economic features of sorghum producers

Some important socio-economic features of the selected farmers have been studied and results are presented below under different sub heads.

4.1.1 Family size and its composition

Family labour contributes a substantial portion of on farm labour force. The sufficient or scanty availability of labour helps to determine the requirement of the hired human labour for on-farm operations. Therefore the data pertaining to family size and its composition of sample jowar growers was collected and depicted in Table 4.1.

Table 4.1, indicated that the average family size and it's composition for M 35-1(Maldandi) and Revati cultivar was 4.62 members and 4.58 members respectively. The average family size was inclusive of 49.73 per cent male members and 30.95 per cent female members. The average number of children was 19.32 per cent. From total members of M 35-1(Maldandi) growers family, 37.53 per cent members were engaged in on farm activities. Age of M 35-1(Maldandi) famers at overall level was 45.72 years.

The proportion of male and female members of Revati growers family was 49.46 per cent and 30.50 per cent respectively. The number of children pertaining to Revati grower's family was 20.04 per cent of the family size. The average age of Revati growers was 45.35 years. From total members of Revati sample growers, the family labour availability for on farm work was 35.03 per cent.

From Table 4.1, it was revealed that there was no much difference in the average family size of M 35-1(Maldandi) and Revati growers.

Education is another important factor influencing the ability and technical knowledge of the farmers.

Table 4.1 Family size and it's composition of sample sorghum growers

(Numbers)

Sr. no.	Particulars	M 35-1				Revati			
		Size Groups							
1	**Family size**	**Small**	**Medium**	**Large**	**Overall**	**Small**	**Medium**	**Large**	**Overall**
	Male	2.33 (49.26)	2.27 (48.82)	2.30 (51.11)	2.30 (49.73)	2.30 (48.83)	2.20 (47.83)	2.30 (52.27)	2.27 (49.46)
	Female	1.50 (31.71)	1.50 (32.26)	1.30 (28.89)	1.43 (30.95)	1.40 (29.42)	1.50 (32.61)	1.30 (29.55)	1.40 (30.50)
	Children	0.90 (19.03)	0.88 (18.92)	0.90 (20.00)	0.89 (19.32)	1.01 (21.44)	0.90 (19.57)	0.80 (18.18)	0.92 (20.04)
	Sub Total	4.73 (100)	4.65 (100)	4.50 (100)	4.62 (100)	4.71 (100)	4.60 (100)	4.40 (100)	4.58 (100)
2	**Members working on Farm**	1.77 (37.42)	1.77 (38.06)	1.67 (37.11)	1.74 (37.53)	1.72 (36.21)	1.60 (34.78)	1.50 (34.09)	1.61 (35.03)
3	**Age (years)**	43.55	46.30	47.30	45.72	47.00	47.66	41.38	45.35

(Figures in parentheses indicates percentage to the total)

4.2 Educational status

It was noticed that, in M 35-1(Maldandi) grower, only 17.38 per cent family members were having education up to degree level, 36.52 per cent family members were having higher secondary education, 19.39 per cent were having up to secondary education, 19.69 per cent family members were having up to primary education and illiteracy observed in M 35-1(Maldandi) was 7.03 per cent.

In the case of Revati grower, only 16.76 per cent family members were having education up to degree level. 36.58 per cent family members were having higher secondary education, 19.49 per cent were having up to secondary education, 20.05 per cent family members were having up to primary education and 7.11 per cent family members were illiterate.

From Table 4.2 it is observed that Revati growers has more literacy than M 35-1 (Maldandi) growers.

Table 4.2 Educational status of sample sorghum growers

Sr. No.	Particulars	M 35-1				Revati			
		Size groups							
		Small	Medium	Large	Overall	Small	Medium	Large	Overall
1	Up to Primary	0.84 (17.76)	0.95 (20.43)	0.94 (20.89)	0.91 (19.69)	0.99 (20.84)	0.94 (20.43)	0.83 (18.86)	0.92 (20.05)
2	Up to Secondary	0.9 (19.03)	0.9 (19.35)	0.89 (19.78	0.90 (19.39)	0.95 (20.00)	0.85 (18.48)	0.88 (20.00)	0.89 (19.49)
3	Up to Higher secondary	1.82 (38.48)	1.60 (34.41)	1.65 (36.67)	1.69 (36.52)	1.71 (36.00)	1.49 (32.39)	1.82 (41.36)	1.67 (36.58)
4	Up to Degree	0.95 (20.08)	0.87 (18.71)	0.60 (13.33)	0.81 (17.38)	0.77 (16.21)	0.94 (20.43)	0.60 (13.64)	0.77 (16.76)
5	Illiterate	0.22 (4.65)	0.33 (7.10)	0.42 (9.33)	0.32 (7.02)	0.33 (6.95)	0.38 (8.26)	0.27 (6.14)	0.33 (7.12)
	Total	4.73 (100)	4.65 (100)	4.50 (100)	4.63 (100)	4.75 (100)	4.60 (100)	4.40 (100)	4.58 (100)

(Figures in parentheses indicates percentage to the total)

4.3 Occupational pattern

It was seen from the Table 4.3, that amongst M 35-1(Maldandi) growers 75.93 per cent had farming as their main occupation, 11.11 per cent had farming as main occupation and business as subsidiary occupation while 9.26 per cent had service and farming as main and subsidiary occupation while 3.70 per cent had business along with farming as main and subsidiary occupation of the Revati growers.

At overall level , 70.37 per cent growers had farming as main occupation, 14.81 per cent had farming as main occupation along with business as subsidiary occupation and 9.26 per cent had service along with farming as main and subsidiary occupation only 5.56 per cent growers had business as their main occupation and farming a subsidiary occupation.

From the Table 4.3, it was observed that M 35-1(Maldandi) growers has farming as main occupation as compared to Revati growers.

Table 4.3 Occupational pattern of sample sorghum growers

Sr. no	Particular	M 35- 1 sorghum growers				Revati sorghum growers			
		Size Groups							
		Small	Medium	Large	Overall	Small	Medium	Large	Overall
1	Farming	13.00 (72.22)	14.00 (77.77)	14.00 (77.77)	13.67 (75.93)	12.00 (66.66)	13.00 (72.22)	13.00 (72.22)	12.67 (70.37)
2	Farming + Business	2 (11.11)	1 (5.56)	3 (16.67)	2.00 (11.11)	2 (11.11)	3 (16.67)	3 (16.67)	2.67 (14.81)
3	Service + Farming	2 (11.11)	2 (11.11)	1 (5.56)	1.67 (9.26)	1 (5.56)	2 (11.11)	2 (11.11)	1.67 (9.26)
4	Business + Farming	1 (5.56)	1 (5.56)	0 (0.00)	0.67 (3.70)	3 (16.67)	0 (0.00)	0 (0.00)	1.00 (5.56)
	Total	18.00 (100.00)	18.00 (100.00)	18.00 (100.00)	18.00 (100.00)	18.00 (100.00)	18.00 (100.00)	18.00 (100.00)	18.00 (100.00)

(Figures in parentheses indicates percentage to the total)

4.4 Farm Investment in capital assets

Capital assets hold by farm families is an indication of their economic position and it holds good in obtaining credit from financial institutions. The assets generally include land, cattle, shade, electric motor, implements and machinery, pipelines. The per farm investment in capital assets is presented in Table 4.4.The per farm value of farm assets hold by M35-1 growers, ranged from Rs.14,94,151.78 on small farms to Rs.32,25,291.77 on large farms, with an average value of Rs. 22,41,993.83 at overall level. It was noticed that, the land, the basic resource that supports the production of farm commodities was the single most valuable asset on sample farms. The value of land in total capital value contributed 80.89, 86.46, 82.01 per cent, respectively on small, medium and large size farms. An assessment of value of farm inventory excluding land revealed that the value of assets other than land varied from Rs. 2,85,485.11 on small farms to Rs. 5,80,403.77 on large farms was the farm inventory excluding land was Rs 379253.39 at overall.

It is observed that value of assets without land value exhibited direct relationship with the size of the holding. Coming to the machinery and implements, its value was Rs. 65,603.89, Rs. 38,883.89 and Rs. 1,48,839.17 on small, medium and large farms respectively. The value of buildings into consideration, for small farmers was Rs.1,93,777.78 and for medium and large it was Rs.2,05,277.78, Rs. 3,93,333.0 respectively. The higher value of buildings on large farms

revealed the fact that large farmers were more inclined to possess well-constructed house which may last for more years.

The possession of inventory of Revati growers was more as compared to M 35-1(Maldandi) growers. The value of land possessed by Revati grower's was about 2 per cent higher than M 35-1(Maldandi) growers. The per farm value of farm assets in hands of Revati growers ranged between Rs. 29,36,593.50 on small farms to Rs.35,92,072.32 on large farms, with an average value of Rs. 30,29,457.20 at overall level. It was noticed that, the land, the prime factor of farm production was the single most valuable asset on sample farms. The adoption of drip irrigation system was done by medium and large sized farms, while was not the adopted on small sized farms. The contribution of capital assets excluding land value in case of Revati growers was in between 12.62 to 16.27 per cent. The per farm value of farm assets hold by Revati growers, ranged from Rs.25,59,705.78 on small farms to Rs.35,92,072.32 on large farms, with an average value of Rs. 30,29,457.20 at overall level. It was noticed that, the land, the basic resource that supports the production of farm commodities was the single most valuable asset on sample farms. The value of land in total capital value contributed 87.38, 86.67, 83.73 per cent, respectively on small, medium and large size farms.

Table 4.4 Farm Investment in capital assets of sample sorghum growers

Sr. no.	Particulars	Size Groups							
		M 35-1				Revati			
		Small	Medium	Large	Overall	Small	Medium	Large	Overall
		Values (Rs)	Values (Rs)	Values (Rs)	Values (Rs)	Values (Rs)	Values (Rs)	Values (Rs)	Values (Rs)
1	Total land	1208666.67 (80.89)	1734666.67 (86.45	2644888.00 (82.00)	1862740.44 (83.12)	2236555.56 (87.38)	2545000.00 (86.67)	3007777.78 (83.73)	2596444.44 (85.92)
2	House	193777.78 (12.97)	205277.78 (10.23	393333.00 (12.20)	264129.52 (11.80)	188611.11 (7.37)	233000.00 (7.93)	264111.10 (7.35)	228574.07 (7.55)
3	Cattel shade	15075.67 (1.01)	16259.56 (0.81	18361.10 (0.57)	16565.44 (0.80)	15666.67 (0.61)	14372.00 (0.49)	25209.50 (0.70)	18416.06 (0.60)
4	Electric motar	8638.89 (0.58)	5116.67 (0.25	14138.90 (0.44)	9298.15 (0.42)	4666.67 (0.18)	6711.00 (0.23)	10382.50 (0.29)	7253.39 (0.23)
5	Implement and machinary	65603.89 (4.39)	38883.89 (1.94	148839.17 (4.61)	84442.31 (3.63)	99816.89 (3.90)	118927.50 (4.05)	261826.56 (7.29)	160190.31 (5.08)
6	Pipelines	2388.89 (0.160)	3472.22 (0.17	1409.40 (0.04)	2423.50 (0.13)	14388.89 (0.56)	17611.00 (0.60)	19876.00 (0.55)	17291.96 (0.59)
7	Drip	0.000 (0.000)	2861.18 (0.143	4322.20 (0.134)	2394.46 (0.1)	0.00 (0.000)	972.00 (0.033)	2888.89 (0.080)	1286.96 (0.03)
	Value of Total Assets								
a	With land value	1494151.78 (100.00)	2006537.96 (100.00	3225291.77 (100.00)	2241993.83 (100.00)	2559705.78 (100.00)	2936593.50 (100.00)	3592072.32 (100.00)	3029457.20 (100.00)
b	Without land value	285485.11 (19.11)	271871.29 (13.55)	580403.77 (18.00)	379253.39 (16.88)	323150.22 (12.62)	391593.50 (13.33)	584294.55 (16.27)	433012.76 (14.08)

(Figures in parentheses indicates percentage to the total)

4.5 Land Use Pattern

From the Table 4.5, it was observed that, the average size of land holding at overall level was 1.90 and 2.53 hectares for M 35-1(Maldandi) and Revati grower, respectively. The net cropped area pertaining to M 35-1(Maldandi) and Revati growers was 1.79 and 2.41 hectares, respectively.

Table 4.5 Land use pattern of sample sorghum growers (Area in ha)

Sr. no.	Particulars	Size groups							
		M 35-1				Revati			
		Small	Medium	Large	Overall	Small	Medium	Large	Overall
1	Total land holding	1.20 (100)	1.77 (100)	2.72 (100)	1.90 (100)	2.06 (100)	2.29 (100)	3.23 (100)	2.53 (100)
2	Permanent fallow	0.04 (3.33)	0.10 (5.65)	0.18 (6.62)	0.11 (5.20)	0.05 (2.43)	0.11 (4.80)	0.20 (6.19)	0.12 (4.47)
3	Net cropped area	1.16 (96.67)	1.67 (94.35)	2.54 (93.38)	1.79 (94.80)	2.01 (97.57)	2.18 (95.20)	3.03 (93.81)	2.41 (95.53)
4	Gross cropped area	1.95	2.74	4.61	3.10	3.07	3.40	5.66	4.05
5	Cropping intensity (%)	168.41	164.35	181.42	173.30	152.85	156.15	186.80	168.09

(Figures in parentheses indicates percentage to the total)

From the above table, it was seen that, the gross cropped area under M 35-1(Maldandi) and Revati growers at overall level was 3.10 and 4.05 hectares. The cropping intensity, at overall level was observed to be 173.30 and 168.09 per cent for M 35-1(Maldandi) and Revati growers respectively. Total land holding of M 35-1(Maldandi) growers was slightly less than Revati growers. The per cent net cropped area was 94.80 and 95.53, with respect to M 35-1(Maldandi) and Revati growers.

4.6 Cropping Pattern

In Table 4.6, area devoted to different crops at sample farms is presented. The average total net cropped area for M 35-1(Maldandi) grower was observed about 1.16 ha, 1.67 ha and 2.54 ha for small, medium and large size group respectively. At the overall level, M 35-1(Maldandi) jowar occupied 27.88 per cent of total gross cropped area. In *kharif* season, at the overall level major crops were soybean and jowar, which accounted 10.59 and 8.01 per cent of

total gross cropped area, respectively. In *Rabi* season, jowar, gram and wheat were major crops which accounted about, 19.87, 13.11and 9.32 per cent, respectively.

Table 4.6 Cropping Pattern of sample sorghum growers

Sr.No.	Particulars	Size Groups							
		M 35-1				Revati			
		Small	Medium	Large	Overall	Small	Medium	Large	Overall
A	**Kharif Season**								
1	Groundnut	0.11 (5.40)	0.21 (7.49)	0.36 (7.81)	0.22 (7.21)	0.20 (6.51)	0.20 (5.88)	0.33 (5.83)	0.24 (6.02)
2	Soybean	0.07 (3.70)	0.22 (8.10)	0.69 (14.97)	0.33 (10.58)	0.08 (2.60)	0.24 (7.05)	0.55 (9.72)	0.29 (7.17)
3	Red gram	0.17 (8.82)	0.19 (6.88)	0.22 (4.77)	0.19 (6.24)	0.17 (5.61)	0.22 (6.46)	0.20 (3.53)	0.20 (4.88)
4	Maize	0.12 (6.26)	0.21 (7.69)	0.21 (4.58)	0.18 (5.85)	0.10 (3.25)	0.10 (2.94)	0.23 (4.06)	0.14 (3.54)
5	Jowar	0.19 (9.67)	0.22 (7.89)	0.34 (7.38)	0.25 (8.01)	0.21 (6.84)	0.20 (5.88)	0.45 (7.95)	0.29 (7.09)
	Sub total	0.66	1.04	1.82	1.18	0.76	0.96	1.76	1.16
B	**Rabi Season**								
1	Wheat	0.17 (8.67)	0.21 (7.59)	0.49 (10.63)	0.29 (9.32)	0.30 (9.76)	0.32 (9.40)	0.71 (12.54)	0.44 (10.96)
2	Gram	0.29 (14.84)	0.23 (8.38)	0.70 (15.19)	0.41 (13.11)	0.44 (14.32)	0.51 (14.98)	1.31 (23.14)	0.75 (18.62)
3	Jowar	0.33 (17.06)	0.64 (23.18)	0.88 (19.10)	0.62 (19.87)	0.32 (10.42)	0.39 (11.46)	0.61 (10.78)	0.44 (10.88)
	Sub total	0.79	1.07	2.07	1.31	1.06	1.22	2.63	1.64
C	**Summer Season**								
1	Groundnut	0.08 (3.84)	0.02 (0.81)	0.20 (4.34)	0.10 (3.19)	0.20 (6.51)	0.10 (2.94)	0.45 (7.95)	0.25 (6.18)
2	Fodder jowar	0.06	0.01	0.05	0.04	0.10	0.16	0.42	0.23

		(2.97)	0.20	1.25	1.19	3.25	4.70	(7.42)	(5.60)
	Sub total	(0.13)	(0.03)	(0.25)	(0.14)	(0.30)	(0.26)	(0.87)	(0.48)
D	**Perrenial Crops**								
1	Sugarcane	0.22 (11.09)	0.29 (10.49)	0.22 (4.77)	0.24 (7.79)	0.54 (17.58)	0.44 (13.04)	0.15 (2.65)	0.38 (9.34)
2	Pomegranate	0.15 (7.68)	0.31 (11.29)	0.25 (5.43	0.24 (7.63)	0.41 (13.35)	0.52 (15.28)	0.25 (4.42)	0.39 (9.72)
	Sub total	0.37	0.60	0.47	0.48	0.95	0.96	0.40	0.77
	Gross cropped area	1.95	2.74	4.61	3.10	3.07	3.40	5.66	4.05
	Net cropped area	1.16	1.67	2.54	1.79	2.01	2.18	3.03	2.41
	Cropping intensity%	168.41	164.35	181.42	173.30	152.85	156.15	186.80	168.09

(Figures in parentheses indicates percentage to the total)

The cropping intensity observed in small size group was 168.41per cent, in medium size group it was 164.35 per cent and in large size group it was 181.42 per cent. The overall cropping intensity was 173.30 per cent.

In case of Revati grower the average total net cropped area for Revati grower was observed about 2.01 ha, 2.18 ha and 3.03 ha for small, medium and large size group respectively. At the overall level, Revati jowar occupied 17.97 per cent of total gross cropped area. In *Kharif* season, at the overall level major crops were jowar and soybean, which accounted 7.09 and 7.17 per cent of total gross cropped area, respectively. In *Rabi* season, gram, wheat and jowar were major crops which accounted about 18.62, 10.96 and 10.88 per cent, respectively.

The cropping intensity observed in small size group was 152.85 per cent, in medium size group it was 156.15 per cent and in large size group it was 186.80 per cent. The overall cropping intensity was 168.09 per cent.

4.7 Livestock

The maintenance of livestock for manure and human nutrient need by farmers is commonly observed in India. In the study area also the sample farmers were found to be engaged in livestock upkeeping. From the sample farmers under study, the per farm livestock investment of M 35-1(Maldandi) sample growers is presented in Table 4.7. the data inferred that, at overall level, value of bullock, cow, exotic cow, buffalo and goat were Rs.5740.33, Rs.14221.6, Rs.61592.3, Rs.89166.3 and Rs.4481.33, respectively.

In small size group, value of bullock was Rs.7777.00 which was 4.52 per cent of total livestock value. In same manner, cow had value of Rs.12111.00 which was 7.03 per cent, exotic cow had value of Rs. 66444.00 which was 38.6 per cent, buffalo valued for Rs. 68333.00 which was 39.68 per cent of total livestock value.

In medium size group, value of buffalo was Rs.84722.00 which was 39.19 per cent of total livestock value. While exotic cow, local cow, bullock, goat had share of 43.18, 5.27, 00.00 and 1.77 per cent in medium group of size. In large size group, value of buffalo was Rs.114444.00 which was 62.44 per cent of total livestock value. Exotic cow, local cow, bullock, goat had share of 13.64, 10.46, 5.15 and 1.91 per cent, respectively of total livestock value. The total investment on livestock at overall level was Rs.190543.3, medium size group invested Rs.216163.0 which was more than small (Rs.172192.0) and large (Rs.183275) group.

In case of Revati growers, the per farm livestock investment of sample growers were presented in Table 4.7. It can be observed from table that, at overall level, value of bullock, cow, exotic cow, buffalo and goat were Rs.8888.7, Rs. 20092.3, Rs. 56536.7, Rs.73147.7 and Rs. 4796.00, respectively. In small size group, value of bullock was Rs. 13333.00 which was 10.94 per cent of total livestock value. In same manner, cow had value of Rs. 18000.00 which was

14.77 per cent, exotic cow had value of Rs. 39611.00 which was 32.50 per cent, buffalo valued for Rs. 41111.00 which was 33.73 per cent of total livestock value.

In medium size group, value of buffalo was Rs. 101388.00 which was 46.45 per cent of total livestock value. While exotic cow, local cow, bullock, goat had share of 31.31, 10.21, 3.82 and 2.39 per cent in medium group of size. In large size group, value of buffalo was Rs.76944.00 which was 44.01 per cent of total livestock value. Exotic cow, local cow, bullock, goat had share of 35.27, 11.44, 2.86 and 1.97 per cent, respectively of total livestock value. The total investment on livestock at overall level was Rs.171663.53, medium size group invested Rs.218273.0 which was more than small (Rs.121887.6) and large (Rs.174830.00) group.

Table 4.7 Livestock maintained by sample sorghum growers

(Value in Rupees)

Sr. No.	Particulars	M 35-1							
		Small		Medium		Large		Overall	
		M 35-1							
		Number	Valur(Rs.)	Number	Valur(Rs.)	Number	Valur(Rs.)	Number	Valur(Rs.)
1	Bullock	0.16 (4.22)	7777.00 (4.52)	0.00 (0.00)	0.00 (0.00)	0.22 (4.90)	9444.00 (5.15)	0.13 (3.04)	5740.33 (3.22)
2	Cow	0.33 (8.71)	12111.00 (7.03)	0.33 (7.48)	11388.00 (5.27)	0.61 (13.59)	19166.00 (10.46)	0.42 (9.93)	14221.67 (7.59)
3	Cow calf	0.16 (4.22)	2305.00 (1.34)	0.11 (2.49)	1222.00 (0.57)	0.27 (6.01)	2944.00 (1.61)	0.18 (4.24)	2157.00 (1.17)
4	Buffalo	1.11 (29.29)	68333.00 (39.68)	1.27 (28.80)	84722.00 (39.19)	1.70 (37.86)	114444.00 (62.44)	1.36 (31.98)	89166.33 (47.11)
5	Buffalo calf	0.38 (10.03)	6500.00 (3.77)	0.88 (19.95)	17277.00 (7.99)	0.70 (15.59)	7555.00 (4.12)	0.65 (15.19)	10444.00 (5.30)
6	Cow exotic	0.72 (19.00)	66444.00 (38.59)	1.05 (23.81)	93333.00 (43.18)	0.27 (6.01)	25000.00 (13.64)	0.68 (16.3)	61592.33 (31.80)
7	Cow ex. Calf	0.16 (4.22)	2611.00 (1.52)	0.27 (6.12)	4388.00 (2.03)	0.11 (2.45)	1222.00 (0.67)	0.18 (4.24)	2740.33 (1.40)
8	Goat	0.77 (20.32)	6111.00 (3.55)	0.50 (11.34)	3833.00 (1.77)	0.61 (13.59)	3500.00 (1.91)	0.63 (15.08)	4481.33 (2.41)
	Total	3.79 (100.00)	172192.00 (100.00)	4.41 (100.00)	216163.00 (100.00)	4.49 (100.00)	183275.00 (100.00)	4.23 (100.00)	190543.33 (100.00)

(Figures in parentheses indicates percentage to the total)

(Value in Rupees)

Sr. No.	Particulars	Size groups							
		Small		Medium		Large		Overall	
		Revati							
		Number	Valur(Rs.)	Number	Valur(Rs.)	Number	Valur(Rs.)	Number	Valur(Rs.)
1	Bullock	0.27 (8.65)	13333.00 (10.94)	0.22 (4.28)	8333.00 (3.82)	0.10 (2.60)	5000.00 (2.86)	0.20 (5.17)	8888.67 (5.87)
2	Cow	0.44 (14.10)	18000.00 (14.77)	0.61 (11.87)	22277.00 (10.21)	0.50 (13.02)	20000.00 (11.44)	0.52 (13.00)	20092.33 (12.14)
3	Cow calf	0.11 (3.53)	833.30 (0.68)	0.22 (4.28)	2166.00 (0.99)	0.10 (2.60)	1333.00 (0.76)	0.14 (3.47)	1444.10 (0.81)
4	Buffalo	0.66 (21.15)	41111.00 (33.73)	1.50 (29.18)	101388.)00 (46.45	1.20 (31.25)	76944.00 (44.01)	1.12 (27.20)	73147.67 (41.40)
5	Buffalo calf	0.27 (8.65)	2444.00 (2.01)	0.94 (18.29)	8777.00 (4.02)	0.50 (13.02)	4277.00 (2.45)	0.57 (13.32)	5166.00 (2.82)
6	Cow exotic	0.44 (14.10)	39611.00 (32.50)	0.77 (14.98)	68333.00 (31.31)	0.72 (18.75)	61666.00 (35.27)	0.64 (15.94)	56536.67 (33.03)
7	Cow ex. Calf	0.05 (1.60)	833.30 (0.68)	0.11 (2.14)	1777.00 (0.81)	0.22 (5.73)	2166.00 (1.24)	0.13 (3.16)	1592.10 (0.91)
8	Goat	0.88 (28.21)	5722.00 (4.69)	0.77 (14.98)	5222.00 (2.39)	0.50 (13.02)	3444.00 (1.97)	0.72 (18.74)	4796.00 (3.02)
	Total	3.12 (100.00)	121887.60 (100.00)	5.14 (100.00)	218273.00 (100.00)	3.84 (100.00)	174830.00 (100.00)	4.03 (100.00)	171663.53 (100.00)

(Figures in parentheses indicates percentage to the total)

4.8 Per Hectare Utilization of Physical Inputs

The inputs such as human, bullock and machine labour, seed, manures, fertilizers, and plant protection charges used in cultivation of M 35-1 and Revati cultivars of sorghum production were estimated on per hectare basis and presented in Table 4.8.

Table 4.8 Per Hectare Input Utilization of Sorghum growers

Sr. No	Particulars	Size Groups							
		Small	Medium	Large	Overall	Small	Medium	Large	Overall
		M 35-1				Revati			
1	Male	13.24	13.53	11.69	**12.82**	14.28	15.72	16.68	**15.56**
	Female	24.48	25.74	12.88	**21.03**	29.32	30.19	28.09	**29.20**
	Total Human labour (Days)	37.72	39.27	24.57	**33.85**	43.60	45.91	44.77	**44.76**
2	Bullock Labour (pair)	10.29	10.42	10.43	**10.38**	9.81	11.14	10.17	**10.37**
3	Machine labour(hours)	2.08	3.05	2.10	**2.41**	3.64	2.60	2.76	**3.00**
4	Manures(Qtl)	60.73	63.67	64.25	**63.96**	69.76	70.86	65.06	**68.56**
5	Fertilizer (kg)								
6	N	87.73	77.52	48.56	**71.27**	75.70	77.14	78.20	**77.01**
	P	47.88	36.44	24.49	**36.27**	36.65	35.06	30.92	**34.21**
	K	36.55	26.36	23.48	**28.80**	35.19	36.08	33.13	**34.80**
7	Seed (Kg)	10.29	10.48	15.96	**12.24**	12.55	12.58	12.88	**12.67**
8	Plant protection (Rs.)	749.2	527.87	607.7	**628.3**	1335.1	885.48	596.6	**939.07**

It is revealed that per hectare human labour used for M 35-1(Maldandi) production was 33.85 man days which was relatively less than that of Revati production which has 44.76 man days. The use of bullock power was approximately same in production of M 35-1 and Revati. The bullock power use in M 35-1(Maldandi) production (10.38 pair days) and Revati production (10.37 pair days) was almost same. However per hectare utilization of machine power was (2.41 hrs.) for M 35-1(Maldandi) production was lower than that of Revati production (3.00 hrs.). Per hectare use of manures in production of Revati (68.56 qtls) was 5.5 quintals more as compare to M 35-1 (63.96 qtls) production.

Per hectare fertilizer use for M 35-1(Maldandi) production was 71.27 kg N, 36.27 kg P and 28.80 kg of K. However for Revati production per hectare fertilizer use was 77.01 kg N, 34.21 kg P and 34.80 kg K. The data revealed that the N- fertilizer use was more in Revati production rather than M 35-1 production. The seed rate per hectare was found to be similar i.e. 12.24 kg and 12.67 kg for M 35-1(Maldandi) and Revati production respectively. Revati grower used slightly more seed rate as compared to M 35-1(Maldandi) grower. Plant protection charges were more in Revati production as compared to M 35-1(Maldandi) production.

From the above discussion it is clear that all the resources *viz*, human, machine labour, seed, manures, fertilizers, and plant protection charges used in Revati production were slightly higher over M 35-1 production.

4.9 Cost of cultivation

The estimation of cost of cultivation of M 35-1(Maldandi) and Revati cultivar of sorghum is important to compare the profitability of one cultivar of sorghum over the other. It is important to find, which one of these varieties is extending more profits to sorghum growers either by minimizing the cost through optimum utilization of inputs or by harvesting bumper price due to GI tagging or through higher yield. The comparative economic analysis is essential to test the profitability and viability of production of different cultivars. Therefore, economics of M 35-1(Maldandi) cultivar vis-a-vis Revati cultivar has been calculated and compared.

The item-wise cost of cultivation of M 35-1(Maldandi) and Revati production of jowar has been presented in Table 4.8. The table reveals that human labour occupied the major share (12.36 %) of total cost of ₹ 86724.73 per hectare in Revati production. Also human labour occupied (15.27 %) of total cost of ₹ 58365.55 per hectare in M 35-1(Maldandi) production of sorghum respectively. It can be observed from the table that at the overall level, per hectare cost of cultivation of Revati and M 35-1(Maldandi) i.e. Cost 'C' was ₹ 86724.73 and ₹ 58365.55 respectively. Amongst the Revati different items of cost, rental value was the major item of cost which accounted for ₹ 27472.19 (31.83 %) followed by human labour charges ₹ 10503.77 (12.36 %), seed of ₹ 1276.53 (1.58 %) and machine charges ₹ 1818.34 (2.21 %) in Revati production.

Amongst the M 35-1(Maldandi) different items of cost, rental value was the major item of cost which accounted for ₹ 15092.52 (25.88 %) followed by human labour charges ₹ 8888.89 (15.27%), seed of ₹ 1208.79 (2.13 %) and machine charges ₹ 1467.96 (2.10 %) in Revati production.

The total cost of cultivation of Revati growers Cost ‘A’ was ₹ 50651.86 (58.28 %) and Cost ‘B’ ₹ 82805.12 ((95.44 %) and M 35-1(Maldandi) growers Cost ‘A’ was ₹ 37681.72 (64.51 %) and Cost ‘B’ ₹ 55932.03 (95.83 %). The per hectare total cost of cultivation of Revati was ₹ 102929.59, ₹ 82386.77 and ₹ 74857.83 for small, medium and large size group of holdings, respectively and for M 35-1(Maldandi) was ₹ 61031.63, ₹ 60885.04 and ₹ 53179.97. It has been

observed that the variation in use of different inputs was high on all types of sample farms, which has resulted into vast difference in cost of cultivation of Revati and M 35-1(Maldandi) in all types of farms under study. It was higher for small size followed by medium and large size group of holdings respectively.

From the Table 4.9 it was revealed that, the per hectare cost of cultivation (₹) for M 35-1(Maldandi) was less when compared to that (₹) of Revati. The benefit cost ratio was higher in case of Revati (1.93) as compared to M 35-1(Maldandi) (1.57).

Table 4.9 Cost of cultivation of M 35-1 and Revati cultivar

Sr. No	Particulars	Size group							
		Small	Medium	Large	Overall	Small	Medium	Large	Overall
		M 35-1				Revati			
1	Hired male labour	3972.42 (6.51)	4060.43 (6.67)	3866.20 (7.27)	3966.35 (6.82)	4283.53 (4.16)	4717.62 (5.73)	4839.00 (6.46)	4613.38 (5.45)
	Hired female labour	4896.83 (8.02)	5148.87 (8.46)	4718.92 (8.87)	4921.54 (8.45)	5865.61 (5.70)	6038.87 (7.33)	5766.67 (7.70)	5890.38 (6.91)
	Total	8869.25 (14.53)	9209.30 (15.13)	8585.12 (16.14)	8887.89 (15.27)	10149.14 (9.86)	10756.49 (13.06)	10605.67 (14.17)	10503.77 (12.36)
2	Bullock labour	5394.40 (8.84)	6097.22 (10.01)	5992.13 (11.27)	5827.92 (10.04)	7057.00 (6.86)	6617.18 (8.03)	7577.70 (10.12)	7083.96 (8.34)
3	Machine power	1311.11 (2.15)	1831.67 (3.01)	1261.10 (2.37)	1467.96 (2.51)	2198.61 (2.14)	1600.10 (1.94)	1656.30 (2.21)	1818.34 (2.10)
4	Seed	564.24 (0.92)	1287.36 (2.11)	17974.77 (3.34)	1208.79 (2.13)	651.81 (0.63)	1234.09 (1.50)	1943.68 (2.60)	1276.53 (1.58)
5	Manure	6073.41 (9.95)	6367.87 (10.46)	6400.82 (12.04)	6280.70 (10.82)	6976.32 (6.78)	7086.75 (8.60)	6506.55 (8.69)	6856.54 (8.02)
6	Fertilizer cost	1757.04 (2.88)	1231.07 (2.02)	910.01 (1.71)	1299.37 (2.20)	1392.601 (1.35)	1392.87 (1.69)	1312.96 (1.75)	1366.15 (1.60)
7	Irrigation	778.84 (1.28)	840.52 (1.38)	821.86 (1.55)	813.74 (1.40)	3578.96 (3.48)	3825.72 (4.64)	3038.63 (4.06)	3481.10 (4.06)
8	Plant PC	749.23 (1.23)	527.87 (0.87)	607.69 (1.14)	628.27 (1.08)	1335.09 (1.30)	885.48 (1.07)	596.64 (0.80)	939.07 (1.06)
9	Incidental C	824.49 (1.35)	502.58 (0.83)	490.90 (0.92)	605.99 (1.03)	1061.27 (1.03)	750.50 (0.91)	514.52 (0.69)	775.43 (0.88)
10	Repairs	960.25 (1.57)	498.12 (0.82)	406.60 (0.76)	621.66 (1.05)	901.80 (0.88)	601.40 (0.73)	435.72 (0.58)	646.31 (0.73)
11	Working Capital	27282.26 (44.70)	28393.59 (46.63)	27251.01 (51.24)	27642.28 (47.53)	35302.61 (34.30)	34750.59 (42.18)	34188.36 (45.67)	34747.19 (40.72
12	Interest on W.C.	1636.94 (2.68)	1703.62 (2.80)	1635.06 (3.07)	1658.54 (2.85)	2118.16 (2.06)	2085.04 (2.53)	2051.30 (2.74)	2084.83 (2.44)
13	Depreciation charge	10346.89	9530.24	4637.70	8171.61	23911.50	9909.98	7018.16	13613.21

		(16.95)	(15.65)	(8.72)	(13.78)	(23.23)	(12.03)	(9.38)	(14.88)
14	Land revenue	200.00 (0.33)	256.67 (0.42)	171.20 (0.32)	209.29 (0.36)	235.09 (0.23)	160.40 (0.19)	224.40 (0.30)	206.63 (0.24)
15	**COST A**	**39466.08 (64.66)**	**39884.11 (65.51)**	**33694.97 (63.36)**	**37681.72 64.51)**	**61567.36 (59.82)**	**46906.01 (56.93)**	**43482.22 (58.09)**	**50651.86 (58.28)**
16	Rental value of land	16189.87 (26.53)	14999.70 (24.64)	14088.00 (26.49)	15092.52 (25.88)	30838.30 (29.96)	27712.36 (33.64)	23865.90 (31.88)	27472.19 (31.83)
17	Interest on fixed capital	2620.92 (4.29)	3627.94 (5.96)	3224.50 (6.06)	3157.79 (5.44)	6078.16 (5.91)	4436.00 (5.38)	3529.06 (4.71)	4681.07 (5.33)
18	**Cost B**	**58276.87 (95.49)**	**58511.75 (96.10)**	**51007.47 (95.91)**	**55932.03 (95.83)**	**98483.82 (95.68)**	**79054.37 (95.96)**	**70877.18 (94.68)**	**82805.12 (95.44)**
19	Family male labour	1856.35 (3.04)	1284.81 (2.11)	965.70 (1.82)	1368.95 (2.32)	2771.43. (2.69)	2038.40 (2.47)	2338.00 (3.12)	2188.20 (2.76)
20	Family female labour	898.41 (1.47)	1088.48 (1.79)	1206.80 (2.27)	1064.56 (1.84)	1674.34 (1.63)	1294.00 (1.57)	1642.65 (2.19)	1537.00 (1.80)
21	Total	2754.76 (4.51)	2373.29 (3.90)	2172.50 (4.09)	2433.52 (4.17)	4445.77 (4.32)	3332.40 (4.04)	3980.65 (5.32)	3919.61 (4.56)
22	**Cost C**	**61031.63 (100.00)**	**60885.04 (100.00)**	**53179.97 (100.00)**	**58365.55 (100.00)**	**102929.59 (100.00)**	**82386.77 (100.00)**	**74857.83 (100.00)**	**86724.73 (100.00)**
	Main Produce	47267.00	52786.50	52407.30	50820.27	126379.60	126973.90	109573.50	120975.67
	By Produce	51025.60	38411.80	33320.70	28162.64	60060.71	40500.29	17678.35	39413.12
	Gross Value	98292.60	91198.30	85728.10	91739.67	186440.30	167474.20	144542.00	166152.17
	B:C ratio	1.61	1.50	1.61	1.57	1.81	2.03	1.93	1.93
	Per qtl	3945.20	3806.29	3348.65	3700.05	2850.57	2103.40	2474.05	2476.01

(Figures in the parenthesis indicates percentage to the total)

4.10 Profitability of M 35-1 and Revati cultivar of Sorghum

An attempt has been made to compare the per hectare gross income, different cost and profit at different costs with the net returns and the benefit cost ratio for M 35-1(Maldandi) and Revati production the details are given in the table 4.10

It reveals that all the costs were higher in Revati production over M 35-1(Maldandi) production in sorghum. The cost A, B and C were higher in Revati production in comparison to M 35-1(Maldandi) production respectively. The Per hectare gross income received by Revati grower was ₹ 166152.2 and it was ₹ 91739.7 in case of M 35-1(Maldandi) grower therefore, Revati grower obtain more gross income than M 35-1(Maldandi) grower. Higher gross income was mainly due to higher productivity. In case of Revati production as compare to M 35-1(Maldandi) production the productivity is more in Revati. Revati production gives higher returns with higher B: C ratio as compared to M 35-1(Maldandi) production. The B:C ratio at cost 'C' was 1.93 in case of Revati production as compared to 1.57 in M 35-1(Maldandi) production. The B: C ratio of more than unity indicated that the Revati production in the study area is a economically viable proportion. Hence the hypotheses Revati production is more profitable than M 35-1(Maldandi) production has been accepted. Hence the hypothesis is proved that, cultivation of Revati sorghum is profitable than M 35-1(Maldandi).

Table 4.10 Cost, returns , gross income and B: C ratio for M 35-1 and Revati cultivars of Sorghum

Sr. No.	Particulars	M 35-1				Revati			
		Size Group				Size Group			
		Small	Medium	Large	Overall	Small	Medium	Large	Overall
1	Gross returns	98292.6	91198.3	85728.1	91739.7	186440.3	167474.2	144542.0	166152.2
2	Costs (Rs.)								
	i) Cost A	39466.1	39884.1	33695.0	37681.7	61567.4	46906.0	43482.2	50651.9
	ii) Cost B	58276.9	58511.8	51007.5	55932.0	98483.8	79054.4	70877.2	82805.1
	iii) Cost C	61031.6	60885.0	53180.0	58365.5	102929.6	82386.8	74857.8	86724.7
3	Profit (Rs.)								
	i) Cost A	58826.5	51314.2	52033.1	54057.9	124872.9	120568.2	101059.8	115500.3
	ii) Cost B	40015.7	32686.5	34720.6	35807.6	87956.5	88419.8	73664.8	83347.0
	iii) Cost C	58276.9	58511.8	51007.5	55932.0	98483.8	79054.4	70877.2	82805.1
4	Production	15.5	16.0	15.9	15.8	36.1	39.2	30.3	35.2
5	Per Qtl cost of production	3945.2	3806.3	3348.6	3700.0	2850.6	2103.4	2474.1	2476.0
6	Benefit - Cost ratio								
	i) Cost A	2.49	2.29	2.54	2.44	3.03	3.57	3.32	3.31
	ii) Cost B	1.69	1.56	1.68	1.64	1.89	2.12	2.04	2.02
	iii) Cost C	1.61	1.50	1.61	1.57	1.81	2.03	1.93	1.93

4.11 Functional analysis

4.11.1 The Cobb-Douglas production function for M 35-1 and Revati cultivars of sorghum

The result of the Cobb-Douglas production function are presented in Table 4.11.The Cobb-Douglas type of production function was used to study the effect of various inputs on Revati and M 35-1(Maldandi) production.

Table 4.11 Result of estimated Cobb-Douglas production function for M 35-1 and Revati

Sr. No.	Particulars	**M 35-1**	**Revati**
1	Intercept	-1.09 (0.32)	-0.66 (0.23)
2	Seed (X1)	0.14** (0.06)	0.07* (0.04)
3	Male (X2)	-0.21 (0.19)	0.03 (0.04)
4	Female (X3)	-0.15 (0.17)	0.06 (0.09)
5	Manure (X4)	0.25* (0.14)	0.15 (0.13)
6	N (X5)	0.16** (0.07)	-0.21 (0.16)
7	P (X6)	0.32*** (0.10)	0.05 (0.16)
8	K (X7)	0.02 (0.04)	0.41** (0.16)
9	IRR (X8)	0.54*** (0.18)	0.32*** (0.10)
10	PPC (X9)	0.11*** (0.04)	0.099* (0.05)
11	**R^2**	**0.90**	**0.94**

(Figures in parentheses are standard error)

* Significant at 10 per cent level of significance

** Significant at 5 per cent level of significance

*** Significant at 1 per cent level of significance

From Table 4.11, it was observed that, in case of Revati production, the value of R^2 was 0.90 and for M35-1 production, it was 0.96, it indicated that the factor under consideration *viz*., Seed (X1),Male labour (X2),Female (X3),Manures (X4),N quantity in (X5), P quantity in (X6),K quantity in (X7),Irrigation charges (X8) and plant protection charges (X9) explained 90 per cent and 96 per cent variation in output of Revati and M-35 production, respectively.

It was further observed that in case of Revati production of sorghum, the irrigation (X8) was positively significant at 1 per cent level of significance. It indicates that, one per cent increase in the irrigation would increase the output of Revati production by 0.32 per cent. However K (X7) was positive and significant at 5 per cent level of significance. Also seed (X1) and PPC (X9) were positive and significant at 10 per cent level of significance. The positive relationship indicates increase output with increase output. However Male (X2), Female (X3), manure (X4) and Phosphorous (X6) were positive but not significant, positive relationship of male, female manure and phosphorous indicates that with increase in input , output would also increase. It indicates that they have positive impact on output.

In case of M 35-1(Maldandi) production the value of (R^2) was found to be 0.90, that means 90 per cent variation in output was jointly explained by the some independent resource variables under consideration table (4.11). It was observed that P (X6), IRR (X8) and PPC (X9) were positive and significant at 1 per cent level of significance. However Manure (X4) was positive and significant at 10 per cent level of significance. Seed (X1) and N (X5) were positive and significant at 5 per cent level of significance. K (X7) was positive but not significant. The positive relationship of potassium indicates that with increase in input, output would also increase. This indicates that there is scope to increase the use of these resources to increase the production.

These significant variables indicated that, the increase in use of these resource variables would increase the output of M 35-1(Maldandi) production of Sorghum.

4.11.2 Resource use efficiency in production of M 35-1 and Revati cultivars of Sorghum

The marginal value of product to factor cost (MVP/FC) ratio was used to assess the efficiency of resources used in M 35-1(Maldandi) and Revati production on the sample farms, and the result are given in table 4.12.

It was revealed that the ratio of marginal value of product to factor cost ratio (MVP / FC) ratio was greater than unity (i.e. under utilization) in case of M 35-1(Maldandi) resources like Seed (X1), Manure (X4), N (X5), P (X6), K (7) Irr (X8) and Ppc (X9) of M 35-1(Maldandi) production, implying the achievement of higher resource use efficiency in case of above mentioned variables, were as MVP / FC ratio of Male (X2) and Female (X3) were found to be less than unity i. e. over utilization for these resources. These indicate that there is no need to

increase in Male (X2) and Female (X3) inputs for increasing the output. The MVP / MC ratio of Male (X6) and K (X7) were found to be negatively greater than unity which shows that there is need to decrease these inputs for increasing the outputs.

Table no 4.12 Resource use efficiency in production of M 35-1 and Revati cultivars of Sorghum

	M 35-1				Revati			
Part.	MVP	FC (Px)	MVP/FC	Remark	MVP	FC (Px)	MVP/FC	Remark
Seed	516.4	65	7.94	Under	745.62	65	11.47	under
Male	-733.0	300	-2.44	Excess	274.45	300	0.91	excess
Female	-289.8	200	-1.45	Excess	250.76	200	1.25	under
Manure	190.1	100	1.90	Under	287.07	100	2.87	under
N	95.7	6	15.94	Under	-329.25	6	-54.87	excess
p	434.3	8	54.29	Under	179.61	8	22.45	under
K	26.8	18	1.49	Under	1284.09	18	71.34	under
Irr	42.2	1	42.17	Under	62.78	1	62.78	under
PPc	8.9	1	8.89	Under	13.57	1	13.57	under

It was observed that the ratio of marginal value of product to factor cost ratio (MVP / FC) ratio was greater than unity (i.e. under utilization) in case of Revati resources like Seed (X1), Female (X3), Manure (X4), P (X6), K (X7), Irr (X8) and Ppc (X9) of Revati production, implying the achievement of higher resource use efficiency in case of above mentioned variables, were as MVP / FC ratio of Male (X2), and N (X5) were found to be less than unity i. e. over utilization for these resources. These indicate that there is no need to increase in Male (X2), and N (X5) inputs for increasing the output. The MVP / MC ratio of N (X5) was found to be negatively greater than unity which shows that there is need to decrease these inputs for increasing the outputs.

4.12 Marketing Channels followed for disposal of Sorghum

Marketing channels are the alternative routes of product-flows from producers to consumers. In the study area farmers used following three major channels for marketing of jowar.

Channel-I

Producer - Consumer

Channel-II

Producer - Wholesaler - Retailer - Consumer

Channel-III

Producer - Retailer - Consumer

Among the three marketing channels, the most commonly used channel for marketing of Revati and M 35-1 in the study area was Channel-II as 57.19 and 56.62 per cent of the produce marketed through this channel. The detailed information on the quantity of produce sold through different channels by the jowar growers in different markets is presented in Table 4.14.

4.13 Production and disposal pattern of Sorghum

The total production of M 35-1(Maldandi) and Revati was disposed off as home consumption, gratis, losses due to wind, losses due to pests and the rest was marketed. The information regarding the disposal pattern of Jowar is given in Table 4.13

Table 4.13 Production and disposal pattern of sorghum

Qtls/ha

Sr no	Particulars	Size groups							
		Small	Medium	Large	Overall	Small	Medium	Large	Overall
		M 35-1				Revati			
1	Total Production (qtl)	15.47 (100)	16.00 (100)	15.88 (100)	15.78 (100)	36.11 (100)	39.17 (100)	30.26 (100)	35.18 (100)
2	Use for Seed (kg)	0.10 (0.61)	0.17 (1.07)	0.22 (1.41)	0.16 (1.03)	0.13 (0.35)	0.17 (0.44)	0.23 (0.75)	0.17 (0.51)
3	Home consumption (kg)	0.54 (3.48)	0.91 (5.68)	1.24 (7.80)	0.90 (5.66)	0.67 (1.85)	0.93 (2.38)	1.24 (4.10)	0.95 (2.78)
4	Gratis (kg)	0.13 (0.84)	0.26 (1.63)	0.26 (1.61)	0.22 (1.36)	0.13 (0.37)	0.20 (0.52)	0.26 (0.86)	0.20 (0.58)
6	Losses (kg)	0.19 (1.25)	0.30 (1.85)	0.35 (2.20)	0.28 (1.77)	0.22 (0.60)	0.33 (0.84)	0.35 (1.17)	0.30 (0.87)
7	Total	0.96 (6.19)	1.64 (10.22)	2.07 (13.02)	1.55 (9.81)	1.14 (3.16)	1.64 (4.17)	2.09 (6.88)	1.62 (4.74)
8	Marketable quantity	14.51 (93.81)	14.36 (89.78)	13.81 (86.98)	14.23 (90.19)	34.97 (96.8)	37.53 (95.83)	28.17 (93.12)	33.56 (95.26)

(Figures in parentheses indicate percentage to the total).

In case of Revati growers it is revealed that, the per hectare total quantity of Revati jowar produced were 36.11 quintals, 39.17 quintals and 30.26 quintals in small, medium and large size groups, respectively. Out of this total production 1.85 per cent was used for home consumption by small groups, whereas 2.38 per cent and 4.10 per cent were used for home consumption for medium and large size groups, respectively. The per hectare quantity lost due to pests was 0.60 per cent, 0.84 per cent and 1.17 per cent of total produce for small, medium and large groups respectively. At overall level quantity used for gratis were worked out to 0.58 per cent of the total produce and the marketable surplus available was 95.26 per cent i.e. 33.56 quintals per hectare.

In case of M 35-1(Maldandi) growers, it is revealed that, the per hectare total quantity of M 35-1 jowar produced were 15.47 quintals, 16.00 quintals and 15.88 quintals in small, medium and large size groups, respectively. Out of this total production 3.48 per cent was used for home consumption by small groups, whereas 5.68 per cent and 7.8 per cent were used for home consumption for medium and large size groups, respectively. The per hectare quantity lost was 1.25, 1.85 and 2.20 per cent of total produce for small, medium and large groups respectively. At overall level quantity used for gratis were worked out to 1.36 per cent of the total produce. The marketable surplus available was 14.51, 14.36 and 13.81 quintals in small, medium and large size group. At overall level the marketable surplus available was 90.19 per cent i.e. 14.23 quintals per hectare.

4.14 Channel wise disposed-off quantity in M 35-1 and Revati cultivars of Sorghum

It can be seen that there are three different marketing channels for Revati grower. It was observed that at the overall level, marketing Channel-II (Producer – Wholesaler – Retailer - Consumer) was the most preferred channel through which 57.19 per cent of the total produce was marketed followed by Channel-I (Producer - Consumer) and Channel-III (Producer - Retailer - Consumer) through which 38.71 and 4.10 per cent, respectively.

There is total quantity of Revati cultivar is 31.24 qtl/ha out of which 17.81 qtl/ha through channel -II followed by 12.12 qtl/ha through channel -I.

In case of M 35-1(Maldandi) it was observed that at the overall level, marketing channel-II was most preferred channel through which 56.62 per cent of the total produce was marketed followed by channel-I and channel-II through which 33.61 and 9.77 per cent respectively. There is total quantity of M 35-1 cultivar is 14.53 qtl/ha out of which 8.36 qtl/ha through channel -II followed by 1.32 qtl/ha through channel –I

Table 4.14 Channel wise disposed-off quantity of sorghum

(Qtl./ha)

Sr. no.	Channel	Size Groups							
		Small	Medium	Large	Overall	Small	Medium	Large	Overall
		M 35-1(Maldandi)				Revati			
1	I	3.132 (24.88)	6.3 (46.81)	5.11 (29.13)	4.85 (33.61)	11.850 (38.35)	14.02 (39.87)	10.48 (37.90)	12.12 (38.71)
2	II	7.035 (55.89)	6.38 (47.40)	11.67 (66.57)	8.36 (56.62)	17.76 (57.48)	19.24 (54.72)	16.42 (59.39)	17.81 (57.19)
3	III	2.421 (19.23)	0.7792 (5.79)	0.75 (4.30)	1.32 (9.77)	1.29 (4.17)	1.9 (5.40)	0.75 (2.71)	1.31 (4.10)
	Total	12.59 (100)	13.46 (100)	17.54 (100)	14.53 (100)	30.90 (100)	35.16 (100)	27.65 (100)	31.24 (100)

(Figures in parentheses indicates percentage to the total)

4.15 Marketing Costs, Price spread in Marketing Channels of Sorghum

The marketing cost is the sum total of all costs incurred in the movement of produce and includes costs such as loading, unloading, packing, transportation, market fee, commission etc. The costs incurred by producer seller and the intermediaries in handling Jowar were worked out and presented in following Table 4.15.

In case of Revati in Channel I, there was negligible marketing cost incurred and there was no market margin. At overall level, total marketing cost incurred by producer is Rs.83.24. This cost was especially due to the transportation and losses faced by producer while selling their produce.

Price spread is the difference between price paid by consumer and price received by producer. This consists of marketing costs and margins of the different intermediaries. The costs and margins of agency in different channels were worked out and details are presented in Table.

It is observed from the Table 4.15 that, In case of Revati the net per quintal cost incurred were Rs.83.24, Rs. 449.00 and Rs.200.00 in Channel I, II, and III, respectively. Per quintal cost was high in Channel II because so many intermediaries included in that channel and produce was marketed to distant markets.

Table 4.15 Channel wise Marketing Cost, Price Spread in Sorghum Marketing

Sr. no.	Particulars	M 35-1(Maldandi)			Revati		
		Channel-I	Channel-II	Channel-III	Channel-I	Channel-II	Channel-III
1	**Gross price received by the farmer**	3526.00 (97.89)	3242.09 (89.14)	3494.33 (95.10)	3566.40 (97.72)	3499.46 (88.63)	3512.57 (94.61)
	i) Marketing cost	76.04 (2.11)	0.00 (0.00)	0.00 (0.00)	83.24 (2.28)	0.00 (0.00)	0.00 (0.00)
	ii) Net price realized	3449.96 (95.78)	3242.09 (89.14)	3494.33 (95.10)	3483.16 (95.44)	3499.46 (88.63)	3512.57 (94.61)
2	**Wholesaler**						
	i) Price paid	-	3242.1 (89.14)	-	-	3499.46 (88.6)	-
	ii) Marketing cost	-	65.0 (1.8)	-	-	74.0 (1.9)	-
	iii) Marketing margin	-	100.0 (2.7)	-	-	125.0 (3.2)	-
	iv) Price received	-	3407.1 (93.7)	-	-	3698.5 (93.7)	-
3	**Retailer**						
	i) Price paid	-	3407.1 (93.7)	3494.33 (95.10)	-	3698.5 (93.7)	3512.6 (94.6)
	ii) Marketing cost	-	80.0 (2.2)	70.00 (1.91)	-	85.0 (2.2)	80.0 (2.2)
	iii) Marketing margin	-	150.0 (4.1)	110.00 (2.99)	-	165.0 (4.2)	120.0 (3.2)
	iv) Price received	-	3637.1 (100.00)	3674.33 (100.00)	-	3948.5 (100.00)	3712.6 (100.00)
4	**Consumer**						
	Price paid	3602.04 (100.00)	3637.1 (100.00)	3674.33 (100.00)	3649.64 (100.00)	3948.5 (100.00)	3712.6 (100.00)
5	Price spread	76.04	395	180	83.24	449	200
	MC+MM	76.04	395	180	83.24	449	200
	Marketing efficiency	47.37	9.21	20.41	43.84	8.79	18.56
	Producers share in consumers rupees	95.78	859.14	95.10	95.44	88.63	94.61

(Figures in parentheses indicates percentage to the total price paid by consumer)

In Channel II, marketing cost incurred by Wholesaler (Rs.74) was more than any other intermediate. Also, marketing margin was observed high for Wholesaler (Rs.125.00). Net price received by producer in Channel III was more than rest on Channels. It was happened because there were less intermediaries included in this channel. The total marketing cost and market margin was more in channel-II of Revati cultivar followed by channel-III and channel-I Marketing efficiency is more in channel-I than other channel.

In case of M 35-1(Maldandi) in Channel I, there was negligible marketing cost incurred and there were no market margin. At overall level, total marketing cost incurred by producer is Rs.76.04. This cost was especially due to the transportation and losses faced by producer while selling their produce. Price spread is the difference between price paid by consumer and price received by producer. This consists of marketing costs and margins of the different intermediaries. The costs and margins of agency in different channels were worked out and details are presented in Table 4.15.

It is observed from the Table 4.15 that, In case of M 35-1 the net per quintal cost incurred were Rs.76.04, Rs. 395 and Rs.180 in Channel I, II, and III, respectively. Per quintal cost was high in Channel II because so many intermediaries included in that channel and produce was marketed to distant markets.

In Channel II, marketing cost incurred by Wholesaler (Rs.65) was more than any other intermediate. Also, marketing margin was observed high for Wholesaler (Rs.100.00). Net price received by producer in Channel III was more than rest on Channels. It was happened because there were less intermediaries included in this channel. The total marketing cost and market margin was more in channel-II of M 35-1(Maldandi) cultivar followed by channel-III and channel-I. Marketing efficiency is more in channel-I than other channel.

4.16 Marketing Efficiency of Revati and M 35-1(Maldandi)

The Shepherd's method was followed for measuring the marketing efficiency of each channel. The result of marketing efficiency are given in Table. 4.16.

It is observed from Table 4.16 that, the marketing cost of Revati incurred in Channels I, II and III were Rs.83.24, Rs.159 and Rs.80 respectively. There was no margin incurred in Channel I, but it was up to Rs. 290.00 in Channel II and Rs.120.00 in Channel III. Price paid by consumer in Channel II was Rs.3948.46 followed by Channel III Rs.3712.57 and Channel I Rs.3649.64 The marketing efficiency was higher in Channel I (43.84) than that of Channel III (18.56) and Channel II (8.79).

The higher marketing cost and margin in channel II and III resulted into poor efficiency of this channel. Thus the analysis indicated that marketing of Revati jowar directly by farmer without intervention to consumer was most effective and beneficial but it was done rarely as, farmers are unable to sell large quantities of Revati sorghum.

In case of M 35-1(Maldandi) the marketing cost incurred in Channels I, II and III were Rs.76.04, Rs.395 and Rs.180 respectively. There was no margin incurred in Channel I, but it was up to Rs.250.00 in Channel II and Rs.110.00 in Channel III. Price paid by consumer in Channel II was Rs.3637.09. The marketing efficiency was higher in Channel I (47.37) than that of Channel III (20.41) and Channel II (9.21). The higher marketing cost and margin in channel II and III resulted into poor efficiency of this channel.

Table 4.16 Marketing Efficiency of Revati and M 35-1(Maldandi)

		M 35-1(Maldandi)			**Revati**		
Sr. no	**Particulars**	**Channel I**	**Channel II**	**Channel III**	**Channel I**	**Channel II**	**Channel III**
1	Net price Received by the farmer	3449.96	3242.09	3494.33	3483.16	3499.46	3512.57
2	Total marketing cost	76.04	145	70	83.24	159	80
3	Total marketing margin	00.00	250	110	00.00	290	120
	MM+MC	76.04	395	180	83.24	449	200
4	Price paid by consumer	3602.04	3637.09	3674.33	3649.64	3948.46	3712.57
5	Marketing efficiency ratio	47.37	9.21	20.41	43.84	8.79	18.56

Thus the analysis indicated that marketing of M 35-1 jowar directly by farmer without intervention to consumer was most effective and beneficial but it was done rarely as, farmers are unable to sell large quantities of M 35-1(Maldandi) sorghum.

4.17 Problems Faced By M 35-1 and Revati Growers Production

Farmers were asked to list out their problems. Problems were ranked according to priority of farmer. All these were sorted and screened and finally major constraints were identified. Ranks are given according to RPI value as shown in Table 4.17. High value of RPI has given first rank. The major production problem faced by the M 35-1(Maldandi) and Revati growers was non-availability of labour with RPI value 0.47 and 0.57 having rank I followed by high wage rate with RPI value 0.45 and 0.46 (rank II) and quality of produce with RPI value 0.45

and 0.40 (rank III), Non availability of input in time, Difficulty in transportation, Non-availability of bank credit, High fertilizer cost, Technical knowledge about cultivation of Sorghum etc.

Table 4.17 Problems faced by M 35-1 and Revati Growers Production

Sr. no.	Constraints in production	M 35-1								Revati							
		Number in respective priorities					Total recorded responses	RPI	Rank	Number in respective priorities					Total recorded responses	RPI	Rank
		I	II	III	IV	V				I	II	III	IV	V			
1	High wage rate	7	7	10	10	8	42	0.45	**II**	9	7	9	5	9	41	0.46	**II**
2	High fertilizer cost	5	6	3	9	6	29	0.30	**VII**	5	6	5	4	8	27	0.29	**VII**
3	Non-availability of labour	8	10	7	8	9	42	0.47	**I**	10	12	9	11	10	50	0.57	**I**
4	Quality of produce	9	9	6	7	9	40	0.45	**III**	8	9	6	7	5	33	0.40	**III**
5	Non-availability of bank credit	7	4	8	4	5	28	0.33	**VI**	2	7	5	8	7	31	0.30	**VI**
6	Technical knowledge about cultivation of Sorghum	3	8	4	3	4	22	0.26	**VIII**	5	5	5	8	4	25	0.28	**VIII**
7	Non availability of input in time	7	6	9	8	6	36	0.40	**IV**	8	3	7	5	5	32	0.36	**IV**
8	Difficulty in transportation	8	4	7	5	7	31	0.35	**V**	7	5	8	6	6	31	0.35	**V**
	TOTAL	**54**	**54**	**54**	**54**	**54**	**270**			**54**	**54**	**54**	**54**	**54**	**270**		

4.18 Problems Faced By M 35-1 (Maldandi) and Revati Growers Marketing

The M 35-1(Maldandi) and Revati producers were asked to list responses according to their felt priority and the responses were collected and sorted and ranked and major problems were prioritised. The major problem was taken into consideration as fallows by using Response Priority Index (RPI). From Table 4.16, it was observed that the majority of M 35-1(Maldandi) and Revati farmers ranked realization of high transportation charges first on priority basis, with the RPI index 0.51 and 0.50. This was followed by high commission rate which ranked second on priority index 0.41 and 0.38. Lack of market intelligence was ranked III, with response priority index of 0.35 and 0.37. Delay in payment was also expressed as the problem and was given IV rank with the priority index of 0.35 and 0.36.

Table 4.18 Problems faced by M 35-1(Maldandi) and Revati growers in Marketing of sorghum

Sr. No.	Constraints in marketing	M 35-1					Total recorded responses	RPI	Rank	Revati					Total recorded responses	RPI	Rank
		Number in respective priorities								Number in respective priorities							
		I	II	III	IV	V				I	II	III	IV	V			
1	Non availability transportation facilities	6	4	5	3	11	29	0.29	**VI**	7	1	7	6	8	28	0.29	**VI**
2	High transportation charges	8	9	11	10	10	48	0.51	**I**	9	11	8	10	8	44	0.50	**I**
3	Lack of market intelligence	5	8	7	7	2	29	0.35	**III**	7	4	8	6	9	36	0.37	**III**
4	Faulty market management	6	5	5	6	3	25	0.30	**V**	4	7	8	4	7	32	0.33	**V**
5	Faulty measures and weight	10	12	7	10	9	48	0.06	**VIII**	12	14	9	10	8	54	0.06	**VIII**
6	Low price of produce	4	3	4	8	5	24	0.24	**VII**	2	1	3	8	5	15	0.13	**VII**
7	High commission rate	8	6	8	6	11	39	0.41	**II**	6	10	6	7	5	32	0.38	**II**
8	Delay in payment	7	7	7	4	3	28	0.35	**IV**	7	6	7	3	4	31	0.36	**IV**
	TOTAL	54	54	54	54	54	270			54	54	56	54	54	272		

5. SUMMARY AND CONCLUSIONS

Sorghum *(Sorghum bicolor* L.) is the most important crop for food and fodder. It is also called as great millet. In Maharashtra state area under cultivation of sorghum is 2.40 M.ha with production 1.19 M. Tonnes and productivity is 491 kg/ha. Also in Maharashtra major sorghum grown districts are Solapur, Pune, Sangli and Satara. In Maharashtra Solapur district rank first in production (1.84 lakh MT) and also first in area (5.17 lakh hectare).

From Solapur district, Mangalwedha and Barshi Tahsils, having more number of sorghum producers as compare to other Tahsils, were selected purposively. Three villages from each Tehsils i.e. Mangalwedha, Borale and from Mundhewadi Tahsil and Vairag, Mandegaon and Soundare from Barshi Tahsil were selected randomly for present study.

1. To study the costs and returns of M 35-1(Maldandi) and Revati cultivar of sorghum.

2. To study the resource use efficiency.

3. To estimate the marketing costs, price spread and marketing efficiency of sorghum cultivar.

4. To study the problems in production and marketing of sorghum cultivar**.**

Three growers from each of the three predetermined size classes (i.e. area under M35-1(Maldandi) and Revati cultivation) *viz.,* Group I (up to 0.40ha), Group II (0.41 to 0.80ha) and Group III (0.81ha and above) thereby making a total of 18 growers from each village will be selected randomly. Each village consist 9 M 35-1(Maldandi) growers and 9 Phule Revati growers. Thus, the total sample size for the study will consists of 108 sorghum growers comprising 36 for each size group.

5.1 Summary

The data thus collected were analysed by tabular method and the problems in production and marketing were ranked on the basis of response priority index to derive meaningful result. The finding of the study are summarized below.

1) The average family size of Revati grower was 4.58 persons. From total members of Revati sample cultivars 35.03 per cent members are engaged in on farm activities. At overall level family size of M 35-1(Maldandi) grower was 4.63 persons. From total members of M 35-1(Maldandi) sample cultivars 35.03 per cent members are engaged in on farm activities.

2) Literacy status of M 35-1(Maldandi) cultivars was about 92.88 per cent. However 7.02 per cent family members were illiterate. The total literacy of Revati cultivar was about 92.78 per cent and 7.12 per cent family members were illiterate.
3) Occupational pattern of M 35-1(Maldandi) growers showed that 75.93 per cent farmers had farming as their main occupation and 70.37 per cent Revati growers had, farming as their main occupation.
4) The average per farm value of farm assets of M35-1 grower was Rs. 2241993.83.
   At overall level, the per farm value of farm assets of Revati growers was Rs. 3029457.20.
5) The average size of land holding at overall level was 1.90 and 2.53 hectares for M 35-1(Maldandi) and Revati grower, respectively. The gross cropped area under M 35-1(Maldandi) and Revati growers at overall level was 3.10 and 4.05 hectares. Total land holding of M 35-1(Maldandi) growers was slightly less than Revati growers. The per cent net cropped area was 94.80 and 95.53, with respect to M 35-1(Maldandi) and Revati growers.
6) The average total net cropped area for M 35-1(Maldandi) grower was 1.16 ha, 1.67 ha and 2.54 ha for small, medium and large size group respectively. At the overall level, M 35-1(Maldandi) jowar occupied 27.88 per cent of total gross cropped area. The overall cropping intensity was 173.30 per cent.
7) In case of Revati grower the average total net cropped area for Revati grower was observed about 2.01 ha, 2.18 ha and 3.03 ha for small, medium and large size group respectively. At the overall level, Revati jowar occupied 17.97 per cent of total gross cropped area. The overall cropping intensity was 168.09 per cent.
8) Livestock position of M 35-1(Maldandi) growers indicated that The total investment on livestock at overall level was Rs.190543.3, medium size group invested Rs.216163.0 which was more than small (Rs.172192.0) and large (Rs.183275) group and at overall level buffalo have major share of 47.11 per cent in value of total livestock.
9) Livestock position of Revati growers summarized that the total investment on livestock at overall level was Rs.171663.53, medium size group invested Rs.218273.0 which was more than small (Rs.121887.6) and large (Rs.174830.00) group and at overall level the major contribution in value of livestock was 41.40 per cent and that was contributed by buffalo.
10) The seed rate per hectare was 12.24 kg and 12.67 kg for M 35-1(Maldandi) and Revati production respectively. Revati grower used slightly more seed rate as compared to M 35-1(Maldandi) grower. Plant protection charges were more in Revati production as compared to M 35-1(Maldandi) production. In all the resources *viz*, human, machine

labour, seed, manures, fertilizers, and plant protection charges used in Revati production were slightly higher over M 35-1 production.

11) At overall level the per hectare cost of cultivation of M 35-1(Maldandi) was Rs. 58365.55 with benefit cost ratio of 1.57, while in case of Revati cultivar, the overall level Cost C was Rs. 82043.66 with benefit cost ratio of 2.03.
12) Per hectare gross income at overall level for M 35-1(Maldandi) growers was Rs. 91739.7. At overall level the B: C ratio obtained at Cost A, Cost B and Cost C were 1.61, 1.50 and 1.61 respectively. The average per quintal production of M 35-1(Maldandi) was 15.8 qtl/ha.
13) Per hectare gross income at overall level for Revati growers was Rs. 166152.2. At overall level the B: C ratio obtained at Cost A, Cost B and Cost C were 1.93, 2.15 and 2.03 respectively. The average per quintal production of Revati was 35.2 qtl/ha.
14) In case of M 35-1(Maldandi) the value (R^2) was found to be 0.96 that means 96 per cent variation in output. The regression coefficient of M 35-1(Maldandi) for female, manure and irrigation were positive and significant at 1 per cent level of significance. Also male was positive and significant at 10 per cent level of significance. These significant variables indicated that, the increase in use of these resource variables would increase the output of M 35-1(Maldandi) production of Sorghum.
15) In case of Revati the value (R^2) was found to be 0.94 that means 94 per cent variation in output. The regression coefficient of Revati for Irr (X8) was positive and significant at 1 per cent level of significance. Also seed (X1) and PPC (X9) were positive and significant at 10 per cent level of significance.
16) In case of M 35-1(Maldandi) it was revealed that the ratio of marginal value of product to factor cost ratio (MVP / FC) ratio was greater than unity in the resource like male, female, manure, nitrogen, irrigation and Ppc. were under utilized, while as MVP / FC ratio of seed, phosphorous and potassium were found to be less than unity i. e. excess utilization for these resources was revealed.
17) In case of Revati it was revealed that the ratio of marginal value of product to factor cost ratio (MVP / FC) ratio was greater than unity for the resource like seed, female, manure, phosphorous, potassium, irrigation and Ppc and found to be underutilized, whereas MVP/FC ratio of male, and nitrogen were found to be less than unity i. e. over utilization for these resources.
18) In case of M 35-1(Maldandi), at the overall level, marketing channel-II was the most preferred channel through which 56.62 per cent of the total produce was marketed followed by channel-I and channel-II through which 33.61 and 9.77 per cent respectively.

The total quantity of M 35-1 cultivar was c 14.53 qtl/ha out of which 8.36 qtl/ha through channel –II.

19) In case of Revati it was observed that at the overall level, marketing channel-II was most preferred channel through which 57.19 per cent of the total produce was marketed followed by channel-I and channel-II through which 38.71 and 4.10 per cent respectively. There is total quantity of Revati cultivar is 31.24 qtl/ha out of which 17.81 qtl/ha through channel –II.

20) In case of Revati growers it is revealed that, the per hectare total quantity of Revati jowar was 35.18 qtl/ha. At the overall level 2.78 per cent used for home consumption.
The average marketable quantity was about 33.56 qtl/ha (95.26 %).

21) In case of M 35-1(Maldandi) growers it is revealed that, the per hectare total quantity of M 35-1(Maldandi) jowar was 15.78 qtl/ha. At the overall level 5.66 per cent used for home consumption. The average marketable quantity was about 14.23 qtl/ha (90.19 %).

22) Price spread is the difference between price paid by consumer and price received by producer. In case of Revati, the net per quintal cost incurred were Rs.83.24, Rs. 449.00 and Rs.200.00 in Channel I, II, and III, respectively. Per quintal cost was high in Channel II because so many intermediaries included in that channel and produce was marketed to distant markets. The total marketing cost and market margin was more in channel-II of Revati cultivar followed by channel-III and channel-I Marketing efficiency is more in channel-I than other channel.

23) Price spread is the difference between price paid by consumer and price received by producer. In case of M 35-1(Maldandi) in Channel I, there was negligible marketing cost incurred and there were no market margin. At overall level, total marketing cost incurred by producer is Rs.76.04. In case of M 35-1 the net per quintal cost incurred were Rs.76.04, Rs. 395 and Rs.180 in Channel I, II, and III, respectively. Per quintal cost was high in Channel II.

24) The major production problem faced by the M 35-1(Maldandi) and Revati growers was non-availability of labour with RPI value 0.47 and 0.57 having rank I followed by high wage rate with RPI value 0.45 and 0.46 (rank II) and quality of produce with RPI value 0.45 and 0.40 (rank III), Non availability of input in time, Difficulty in transportation, Non-availability of bank credit, High fertilizer cost, Technical knowledge about cultivation of sorghum etc.

25) It was observed that the majority of M 35-1(Maldandi) and Revati farmers ranked realization of high transportation charges first on priority basis, with the RPI index 0.51 and 0.50. This was followed by high commission rate which ranked second on priority

index 0.41 and 0.38. Lack of market intelligence was ranked III, with response priority index of 0.35 and 0.37. Delay in payment was also expressed as the problem and was given IV rank with the priority index of 0.35 and 0.36.

5.2 Conclusions

1. The average family size of M 35-1(Maldandi) growers was at par with Revati growers.
2. Literacy status of Revati and M 35-1(Maldandi) growers was found to be similar and more than 92 per cent growers were literate.
3. The occupational pattern of sorghum growers concluded that about 70 to 75 per cent growers had adopted farming as their main occupation.
4. The average size of land holding at overall level was 1.90 and 2.53 hectares for M 35-1(Maldandi) and Revati grower, respectively it indicated that the total land holding of M 35-1(Maldandi) growers was slightly less than Revati growers. The per cent net cropped area was also little lesser with respect to M 35-1(Maldandi) and Revati growers.
5. The cropping intensity at the overall level was observed in M 35-1(Maldandi) is more as compared to Revati cultivar that was 173.30 and 168.09 per cent respectively.
6. From the above discussion it is clear that the use of all the resources *viz*, human, machine labour, seed, manures, fertilizers, and plant protection charges in Revati production was higher over M 35-1(Maldandi) production in jowar.
7. In comparison, the per ha cost of cultivation of Revati was more than M 35-1(Maldandi) grower. At the overall level the B: C ratio was high in case of Revati as compared to M 35-1(Maldandi) grower i.e. 2.03 and 1.57.
8. The per quintal production of Revati was 35.2 qtl/ha as compared to M 35-1(Maldandi) cultivar which was 15.78 qtl/ha. It indicated that the Revati culivar is producing more than double the output of M 35-1 cultivar.
9. In case of Revati and M 35-1(Maldandi) production, the value of R^2 were 0.94 and 0.96. The regression coefficient of Revati and M 35-1(Maldandi) for Irr (X8) was positive and significant at 1 per cent level of significance.
10. The MVP/FC ratio of M 35-1(Maldandi) and Revati were greater than unity i.e. under utilization resources like female, manure, irrigation and ppc. However The MVP/FC ratio was less than unity means excess (over utilization). In the the case of marketing of M 35-1(Maldandi) and Revati channel II was most preferred channel.
11. Also the total marketing cost and market margin was more in channel-II of M 35-1(Maldandi) and Revati cultivar.

12. Price spread was maximum under channel – II in both varieties i.e. Revati and M 35-1(Maldandi). However, the maximum price spread is observed in Revati as compared to M 35-1(Maldandi).
13. Difficulty in production of M 35-1(Maldandi) and Revati were non-availability of labour, high wage rate, quality of produce and non-availability of input in time etc.
14. Problems in marketing of M 35-1(Maldandi) and Revati were high transport charges, high commission rate, lack of intelligence and delay in payment.

5.3 Policy Implications

- Phule Revati sorghum variety is more profitable than M 35-1 (Maldandi). Therefore to increase their income, more and more number of farmers should take up Revati sorghum variety for the production in areas where sorghum grown predominantly.
- The producer's share in consumer's rupee was more in channel II as compared to channel I and channel III due to involvement of middlemen, therefore study suggest that farmer should be motivated to form Solapur Jowar Producers Organization to minimise number of middlemen in distant marketing and accrue more share in consumers rupee.

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IN

AGRICULTURAL ECONOMICS

2021

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