

**ECONOMIC ANALYSIS OF FORMAL AND INFORMAL
SEED SUPPLY CHAIN FOR *RABI* SORGHUM IN MARGINAL
ENVIRONMENTS OF SAT INDIA**

Report Submitted to

International Crops Research Institute for the Semi-Arid Tropics

Patancheru, 502 324

Andhra Pradesh, India

By

Pragya Vashishta



International Crops Research Institute for the Semi-Arid Tropics

Patancheru, 502 324

Andhra Pradesh, India

icrisat@cgiar.org

DECLARATION

I do hereby declare that the dissertation entitled upon “**Economic Analysis of Formal and Informal Seed Supply Chain for *Rabi* Sorghum in Marginal Environments of SAT India**” is an original and independent record of project work undertaken by me under the supervision of **Dr. N. Nagaraj , (Principal Scientist) at Markets , Institution and Policies, International Crop Research Institute for Semi Arid Tropics (ICRISAT), Patancheru, India**, during the period of my study as part of curriculum of Master in Agri Business Economics.

Patancheru, Hyderabad

By

Date:12th July, 2013

PragyaVashishta

Acknowledgements

I am highly grateful to **Dr. MCS Bantilan**, Research Programme Director, Market Institution and Policies, ICRISAT, for kindly giving me this opportunity to do my project as a part of my academic curriculum. I would also like to thank **Dr N. Nagaraj**, Principal Scientist(Economics), Markets , Institution and Policies, ICRISAT for his guidance and supervision all through my project.

I am grateful to the **Learning Systems Unit (LSU)**, ICRISAT, for providing an opportunity to join this institute of international repute and excellent in research.

My special thanks to **Dr. R. Padmaja** (Scientist-Gender), **Dr. G. Bhasavaraj** (Scientist Economist), **Dr. Madhusudan Bhatarai** (Scientist-Economist), **Dr. Ramalin Thaigarajah** (Scientist Bio-Economic Modelling), for sharing their knowledge and providing timely support.

I wish my thankfulness to **Dr. R.Parchure**,Director,Gokhale Institute of Politics and Economics,Pune,India and **Dr. Jayanti Kajale**, Co-ordinator, M.A. Agri-Business Economics , Gokhale Institute of Politics and Economics, for their support and guidance.

I pay my sincerest gratitude to **Ms R.Anusha** (Scientific Officer),**Padmini Haridas**(Administrative Officer),**TSS Deepti Rajan**(Associate Administration) and **ACF Pamela Samuel**(Associate Documentation) for their appreciable help and support throughout my project.

I would also thank my fellow interns for their relentless support and coordination.

I also take this opportunity to thank my parents and friends for their understanding, coordination and faith in my capabilities to overcome all my hurdles and their great support throughout my project.

Title	: Economic Analysis of Formal and Informal Seed Supply Chain for Rabi Sorghum in Marginal Environments of SAT India
Name	: Pragya Vashishta
Institute	: Gokhale Institute Of Politics And Economics , Pune , India
Supervisor	: Dr. N. Nagaraj
Submitted	: 12th July , 2013

Abstract

Understanding seed systems is crucial for managing crop biodiversity on farm in locations where it is of both private value to farmers and social significance for future crop improvement and the resilience of the farming system. A well-functioning seed system uses the appropriate combination of formal and informal supply channels, market and non-market transactions to stimulate and meet efficiently the evolving demand of farmers for quality seeds. In this study, we have analyzed the role of formal systems related to the delivery of improved varieties of rabi sorghum and informal systems in maintaining the traditional seed systems in the semi-arid regions of India. The outcome of the study would help to analyse the reasons behind declining seed replacement rate and how the seed production generates higher net returns to farmers as compared to grain production. In spite of the release of improved varieties of rabi sorghum, the seeds are not readily available to farmers. This is because Public sector seed production is inadequate and not active, while the private seed sector participation is negligible. Thus understanding seed value chain is crucial for future planning towards quality seed supply of improved varieties.

Keywords: *seed systems, formal seed sector, seed supply, seed value chain*

CONTENTS

Contents	<u>Page No.</u>
1. Introduction	7-10
1.1 General	7
1.2 Importance Of Rabi Sorghum	7-8
1.3 Institutional Arrangement Of Seed Supply System	8-9
1.4 Objectives of the Study	9-10
1.5 Hypotheses Of The Study	10
2. Review Of Literature	11-15
3. Methodology	16-18
3.1 Data Requirement	16
3.2 Source of Data	16
3.3 Method of Data Analysis	17-18
4. Results And Discussions	19-29
4.1 General features of the study area	19-20
4.2 Seed requirement, supply and Gap at Macro level in Maharashtra(2011)	20-21
4.3 The prevailing seed supply chain in the HOPE project clusters and Control areas	22-24
4.4 The seed replacement rate in HOPE and Control area	24-26
4.5 The Economics of informal seed production, distribution and net margins in Nimblak (HOPE area)	27-29
5. Conclusion and Implications	30
References	31-33

Lists of Charts , Tables and Figures

TABLES

Table 4.1 General features of the study area

Table 4.2 Seed requirement, supply and Gap at Macro level in Maharashtra (2011)

Table-4.3 Rabi Sorghum Varieties (Dual Purpose) released by Different Agencies in Maharashtra (2007-12)

Table 4.4 Economics Analysis of Seed Production, Distribution and Net Margins (Perha)

Table 4.5 Incremental Cost-Benefit Analysis of Seed and grain Production (2012-13)

CHARTS

Chart 4.1 Supply chain of rabi sorghum seed in Hope area (Nimblak):

Chart 4.2 Supply chain of Rabi Srghum in Control area (Burudgaon)

Chart 4.3 Proportion to total cost of Seed Production

Chart 4.4 Proportion to total cost of Grain Production

FIGURES

Figure 4.1 Seed replacement in HOPE area

Figure 4.2 Seed replacement rate in Control areas

Figure 4.3. Quantity of seed (qtls) sold by Agro-dealers over the years

1. INTRODUCTION:

1.1 General:

Next to China, India has the highest population of 1.2 billion and likely to reach this 1.7 billion by 2050. In order to meet the growing demands for our increasing production need to be increased. This can only be possible by bridging the existing yield gaps through improved technologies and by integrated natural resource management. Hence, the second Green Revolution would demand much faster growth of seed sector – especially to meet the demand of hybrid seeds and to replace old with new high yielding varieties.

Seed material is the primary input in agriculture and the quality of seed is one of the determinants of output growth, given other complementary inputs. Improved/hybrid seed is an integral part of new technology which is scale neutral. The process of modernizing the Indian agriculture involves the intensive use of non-conventional inputs such as quality seeds, chemical fertiliser, pesticide, weedicide, irrigation, farm machinery and network of research and extension infrastructure. In spite of intensive usage of inputs, agriculture has witnessed stagnant/falling productivity levels in most of the crops and the cost of production has been increasing. As a result, the return to private investment on agriculture is falling. In this scenario, use of quality seed in enhancing the productivity is crucial. (Nagaraj et al., 2004).

The introduction of new technology in Indian agriculture during the mid sixties enabled the country to achieve self- sufficiency in food production. It would not be an exaggeration to say that the green revolution was based on the use of high yielding varieties and crop hybrids responsive to high levels of fertilisers and irrigation. It has been reported that genetically good quality seed can alone increase crop productivity by 15 to 20 per cent (Vanangamudi et al., 2003).

1.2. Importance of Rabi Sorghum

Sorghum is one of the main staple food for the world's poorest and most food insecure people across the semi-arid tropics. Globally, sorghum is cultivated on 41 million hectares to produce 64.20 million tonnes, with productivity hovering around 1.60 tonnes per hectare. With exceptions in some regions, it is mainly produced and consumed by poor farmers. India contributes about 16% of the world's sorghum production. It is the fifth most important cereal crop in the country. In India, this crop was one of the major cereal staple during 1950's and

occupied an area of more than 18 million hectares but has come down to 7.69 million hectares (TE 2010).

There are two distinct sorghum growing seasons in India, *kharif* (rainy season; June–October) and *rabi* (post rainy season; October–January) (Vision 2030). This study is mainly focussed on *rabi* Sorghum.

Post-rainy sorghum is primarily used as a food owing to its good grain quality and also serves as a main source of fodder, especially during dry seasons. The area under post-rainy sorghum has remained stable and is grown predominantly in six districts of Maharashtra (Solapur, Ahmednagar, Pune, Beed, Osmanabad and Aurangabad) and three districts of Karnataka (Bijapur, Gulbarga and Raichur), apart from parts of Andhra Pradesh and Tamil Nadu. Characteristics like resistance to shoot fly, lodging (mechanical) and rust are exemplified best in Maldandi (M 35-1), a variety selected from a local landrace in Maharashtra producing high stable yields of grain and stover across different sowing dates which still dominates in post-rainy season Sorghum area in India (Sanjana Reddy,2012).

Due to less use of improved varieties of rabi Sorghum, the seed replacement rate is also falling. Hence, the outcome of the study would help to identify the entry points for post rainy season sorghum improvement and related seed system interventions.

1.3.Institutional arrangement of seed supply system

Understanding seed systems is crucial for managing seed on farm in locations where it is of both private value to farmers and social significance for future crop improvement and the resilience of the farming system. A well-functioning seed system uses the appropriate combination of formal and informal supply channels, market and non-market transactions to stimulate and meet efficiently the evolving demand of farmers for quality seeds (Maredia et al. 1999).

The seed supply system consists of two main sectors, namely informal and formal seed supply system.

Informal Seed System: It focuses on farmer management of local varieties which have been selected over time and produced under local circumstances. The system is sometimes described as traditional, operating at local level through exchange mechanism and involving

limited quantities per transaction. In addition the varieties have special attributes eg. Tastes and nutrition that give varieties added nutrition within the community.

Informal seed supply systems broadly include:

- (i) Farm-saved seed and farmer-to-farmer exchange
- (ii) Farmers' cooperatives
- (iii) Community groups
- (iv) Seed growers' associations
- (v) Nongovernmental organizations

Formal Seed System :The formal seed system includes those institutions involved in developing, multiplying, and distributing finished varieties as certified seed, and can be publicly and privately-funded and organized in different ways (Morris 1998).

Formal seed supply systems consist of seed production by

- (i) National government agencies
- (ii) State government agencies
- (iii) Government-assisted and other cooperatives
- (iv) Multinational corporations (MNCs) or transnational corporations (TNCs)
- (v) Domestic private sector companies
 - a) with their own research and development (R&D)
 - b) without their own R&D
- (vi) Joint venture companies
 - a) between MNC and domestic private company
 - b) between two domestic companies, et

1.4. Objectives of the study

The overall focus of the study is to analyse the formal systems related to delivery of improved varieties and informal seed systems for maintaining the traditional seed and the profitability of seed production to farmers in comparison with grain production. The seed production sector has adequate prospects and potential to bloom in future, improving seed business have shown the potential for developing sustainable market oriented seed systems.

The **specific objectives** are:

1. To analyse formal and informal seed supply chain of post rainy season sorghum
2. Estimate the Seed Replacement Rate for the rabi season sorghum
3. To assess the economics of informal seed production, distribution and net margins

1.5. Hypotheses of the study:

The **Hypotheses for the study** are:

1. The informal seed system meets the major requirement of seed supply for post rainy season sorghum
2. The Seed Replacement Rate has been extremely low.
3. The Seed Production is relatively more lucrative than grain production.

2. REVIEW OF LITERATURE

The reviews collected from various sources have been grouped under the following broad groups.

2.1 To analyse formal and informal seed supply chain of post rainy season sorghum

2.2 Estimate the Seed Replacement Rate for the rabi season sorghum

2.3 To assess the economics of informal seed production, distribution and net margins

2.1 To analyse formal and informal seed supply chain of post rainy season sorghum

According to Seetharma et al (2007), rabi sorghum is an important crop grown in the Deccan Plateau on ~5.0 m ha area in the states of Maharashtra (3.28 m ha) , Karnataka (1.40) and Andhra Pradesh (0.36) with an annual production of >3.73 m tonnes. Because of their higher quality, large grain size and grain luster, rabi sorghum grains fetch higher market price for the farmers.

According to Poonia (2013), there are different sources of seed supply developed by government of India in order to meet the increasing demand of seed by farmers and others. This has to some extent reduced the dependence of farmers on own saved seeds but has not been able to diminish it fully. At present, 15 State Seeds Corporation and 2 national levels (National Seed Corporations of India & State Farms Corporation of India) are functioning in the country. One of the landmarks in the history of seed programme of India has been the launching of All India Coordinated Research Project (AICRP) on seed called “National Seed Project” in 1979, with 14 centers in different Agricultural Universities. Besides, significant quantities of seeds are also produced by the State Departments of Agriculture, where the State Seeds Corporations are not in existence. For quality control and certification, currently there are 22 State Seed Certification Agencies (SSCAs) and 104 State Seed Testing Laboratories (SSTLs).

Pionetti (2006) mentioned that when asked why seed-saving is essential from farmers in South India, they invariably emphasise the interconnectedness between self-reliance in seed, crop diversity and nutrition.

According to Reddy et al., (2007), the reason almost all smallholder farmers continue to take recourse in farmer-obtained seed (including their own) is not only because of their inadequate access to the formal sector (and to the credit systems that would allow them to exploit it) but also because the few cultivars and varieties on offer in the formal seed sector

do not meet their needs. The informal sector provides a dynamic and flexible supply of seed wanted by smallholder farmers. Furthermore, on-farm production of locally adapted landraces, cultivars and wild species helps farmers cope with specific tropical production problems caused by drought, flooding, heat, cold, pests and diseases.

Pionetti (2006) also mentioned that the continuous exchange of seeds for local crop varieties circulates genetic resources from one field to another within a village territory and beyond. The dynamic management of genetic resources enhances the stability of traditional agro systems, increases the adaptation potential of local crops to evolving environmental conditions and limits the risk of genetic erosion.

Also there are good evidences which show that the seed sector grew steadily in the subsequent period with the establishment of several private seed companies dealing with both field crops and vegetables. Supported by the release of a large number of crop varieties, the growth of the seed sector, predominated by the public seed companies has reached to an annual turnover of about Rs. 500– 600 crores by late 80s (Dravid, 2011).

One of the basic reasons for the declining share of private sector in recent years is the increased dependence of Indian farmers on farm saved seeds. In India it is estimated that over two-thirds of farmers produce seeds from their own harvest (Sahai, 2000). This estimate is remarkably high if we compare it to the percentage of farmers who use farm-saved seeds in Europe, which varies between 10% and 50% depending on the crop and the country.

2.2 Estimate the Seed Replacement Rate for the rabi season sorghum

The seed replacement rate is also influenced by the shrinking share of private sector. This is so because seed replacement rate is the percentage of area sown out of total area of crop planted in the season by using certified/quality seeds/cultivars other than the farm saved seed and the all these quality seeds are supplied by private and public sector in the country. A perusal of the data (DSR/ICAR, 2012) shows that the production of Breeder Seed in different crops is adequate to achieve a desired seed replacement (i.e. around 30% in self pollinated species, 50% in crops pollinated species and 100% in hybrids). Yet the organized seed sector is estimated to cater to only 25-30% of total seed requirement in the country (**Agrawal, 2012; Rabobank, 2012**).

Even if the SRR is increased to 50%, the domestic seed market will exceed to US\$ 5000 million thus bringing India's position to 3rd rank. It may be noted that China with

almost similar area under cultivation as India, has an annual seed market of ~US\$ 9000 million and is ranked 2nd globally (**Paroda, 2013**).

2.3 To assess the economics of informal seed production, distribution and net margins

According to Chopra (1981), the objective of seed production is to build a strong chain of multiplication of the various seed classes. Three stages of multiplication recognized in seed certification are

1. Breeder's seed
2. Basic (foundation) seed, and
3. Commercial (certified) seed.

Breeder's seed is the first multiplication stage after a new superior variety or hybrid has been officially released, notified and recommended for cultivation. The responsibility for the increase of this seed class is usually with the originating breeder or his station. Basic (foundation) seed is frequently produced from breeder's seed. It is not necessary that production of all basic seed be from breeder's seed. As long as trueness-to-type is maintained it can be produced from existing basic seed. Basic seed is multiplied at the university seed farms or at the research farms of seed companies under the supervision of trained seed specialists. This seed class is usually certified because it is used for the production of certified commercial seed. Commercial (certified) seed is produced from basic (foundation or registered) seed. This is the seed sold to farmers to sow their crop. Commercial seed is referred to as certified seed if it is produced according to prescribed standards which ensure trueness-to-type, germination percentage and seed purity. In developing countries, the certified commercial seed is produced either on large government farms or under contract with numerous small but progressive farmers

While coming to the role of formal and informal seed supply system in seed production. The Indian seed market is undergoing an important transformation for the past one-decade and more. The increasing private participation in seed production, development of new varieties for value added crops, and introduction of genetically modified varieties has characterized the new seed regime. (Revathi et al) (2005).

Seed, traditionally was prepared by the farmers by selecting the best lot from their crops. The seeds were exchanged within the farmer's community, and it was used and reused a number of times. The persistent shortage of food grains in the country and unsustainable foodgrain imports in the form of PL 480 led the State to embark on Green Revolution

program in the sixties. As a part of the strategy, production and distribution of seed varieties were undertaken by the public sector, with a set of supporting institutions set up for this purpose. [Pal et al (2002)] . The public sector seed industry was the major player undertaking breeding and multiplication and presence of private sector was negligible.

According to Revathi et al,(2005), the Indian agriculture in has witnessed a gradual shift towards commercialisation of input markets, where seed as a market input is gaining prominence. The implication of commercialisation is at two levels, first is the price factor and second is the quality aspect. According to the data on cost of cultivation (CACP studies) the seed cost has been going up although as a percentage share of the total cost declined in the past one decade. The Indian seed law allows the sale of truthfully labelled seed which leaves the farmer to find his luck regarding the quality of the seed after he sows.

According to Pal et al, (2002), the seed production in India now is undertaken both by public sector as well as private sector. It is important to underscore the role played by the public sector seed companies that concentrated on low value and high volume seeds, like HYVs in food crops that yield only low profits but helped in achieving food self-sufficiency for the country. Whereas the private sector pitched itself on high value and low volume seeds that entail high profit production. The private sector has emerged since eighties and by now it has grown into quite a large and heterogeneous entity. The players in this market include big indigenous companies, multinational companies functioning individually and also in collaboration with Indian companies on the higher end and small farm level operators and unregistered companies in the low end market

While heading towards problems faced by formal sector in seed production, according to Chopra (1981) after superior hybrids have been bred they are evaluated in yield trials and large-scale farmer field trials before release. Most of the seed produced at research centers for evaluation trials is through hand pollinations. A systematic study on the ease of production in farmers' fields under various agro climatic conditions should be done before a hybrid is released for commercial planting; however, this is seldom done. It is left to the seed producing agencies to obtain information. There are genetic problems which a seed producer faces, e.g., the pollen parent may be a shy pollen producer; absence or poor development of female floral parts in some florets due to genetic reasons; large variation in seed size and germinating value of seed from the same panicle; and very poor keeping quality of seed.

According to Paroda, (2013), as a social commitment, the seed producing companies have to come forward to include some low-profit crops in their baskets in the interest of small/resource poor farmers. In this context, an effective partnership between

public and private seed organizations will be highly desirable. Even emerging concept of contract farming through Public-Private-Partnership will be highly beneficial. The state departments may consider procuring quality seeds of improved crop varieties through a Contract Seed Production system by allotting the same, as per their requirements, to the public or private sector companies. This will ensure timely availability of sufficient quantities of seed of the desired (new improved) varieties. A fair competition will keep the rates reasonable, whereas by participating in such activities the private sector can contribute towards their social responsibilities.

3. METHODOLOGY

The present chapter is denoted to discuss the methodology adopted to arrive at specific findings. The study of any research problem needs to be conducted on scientific lines by adopting appropriate methodology to arrive at meaningful conclusion with the specific objectives of the study. The detail of the methodological aspects of the present investigations with regards to the selection of area, sampling, collection of data and analytical procedure adopted etc. is explained in brief.

3.1 Data Requirement:

The data were required on the following aspects

a) Formal and informal seed supply chain of post rainy rabi sorghum:

The data on sources of seed supply chain in Hope and non-Hope areas required to analyse the seed supply chain of rabi sorghum.

b) Estimate seed replacement rate for rabi sorghum:

The data on total area under improved varieties out of total area under rabi sorghum was required to estimate the seed replacement rate of the sampled region

c) To assess the economics of informal seed production, distribution and net margins:

The data on various inputs used in seed production was required to calculate the cost of cultivation, distribution and net margins to farmers.

3.2 Source of Data:

This study was carried out in Western Maharashtra where there is large concentration of rabi sorghum. In the first stage a reconnaissance survey and focussed group meetings were conducted in order to select the rabi sorghum grain and seed producers, seed dealers and other resource persons to get first-hand information relating to existing institutional arrangement for seed supply and production. In the second stage, using a structured questionnaire, primary data on seed production, processing and distribution was collected from the seed producers who have been trained by the HOPE project. Followed by this, interview was conducted with seed dealers/distributors and grain traders to get the information on the status and profile of rabi sorghum seed sales over time.

Sampling

Two villages one from Hope clusters and other from control area were selected. 3 farmers were interviewed from Burudgaon village which is a control area and 2 farmers were selected from Nimblak village which is a Hope cluster. Focussed group meetings were done with 4 Agro-dealers.

Design of Questionnaire

A suitable/appropriate schedule was prepared keeping in view the objectives of the study. The formulated schedules covered all the important aspects such as socio-economic background, area under rabi sorghum, the variety used, implements, machinery, and livestock owned by the sample farmers.

3.3 Method of Data Analysis:

A brief description of analytical procedure in the present study is discussed below.

Estimation of Production Cost and Returns:

Evaluation of Costs :

1) Crops: Both main and by product of the crop were evaluated at the prevailing prices in the respective village at the time of harvest.

2) Human labour: It includes casual hired, permanent hired and family labour. The casual hired labour was evaluated at the actual wages paid to the casual labour. Permanent hired labour (annual farm servant) were evaluated at the actual amount paid in cash is divided by the total number of working days within the year to arrive at wage rate per day. Family labour was evaluated at the wage rates prevailing in the village for casual hired labour.

3) Bullock labour: It include, all bullock labour required for land preparation to threshing and transportation of produce from farm to store has been used in terms of pair days. The evaluation of hired bullock labour was done according to actual amount paid. The evaluation of own bullock labour was done at the wage rate prevailing in the respective villages for hired bullock labour.

4) Machine labour: The hired machine labour evaluated according to actual wages paid. In case of owned machine labour, the evaluation was done at the rate prevailing in the villages for hired machine labour.

5) Seed: Even though the seed was freely provided to the farmers under HOPE Project, the cost of seed was evaluated at prevailing rate of seed in the market.

6) Fertilizer: The fertilizers were charged at the actual price paid by the farmers.

7) Manures: The cost of farm yard manure produced on the farm was evaluated at the rates prevailing in the village. In case of purchased manure the cost was accounted based on actual price paid for the purpose.

The Seed Replacement rate for rabi sorghum was estimated using the information provided by farmers. The formula used for calculating:

Seed Replacement rate=

Area under improved varieties of rab sorghum/Total area under rabi sorghum

Total Cost per hectare = Cost of production + Post harvesting and Marketing cost

Return to Cost Ratio= Gross Returns/Total Cost per hectare

Gross Returns= Total value of main product + total value of by product

Cost per kg= total cost per hectare / yield (kg) per hectare

Net Margins = Gross returns – total cost

Incremental Cost Benefit Ratio=Added Returns per hectare/Added cost per hectare

4. RESULTS AND DISCUSSIONS

This chapter deals with presentation and interpretation of the results of the study. The major objectives of the study is to analyse the formal and informal seed supply chain of post rainy rabi sorghum , to estimate the seed replacement rate and to study the economics of informal seed production , distribution and net margins. The data pertaining to 5 farm families of Hope and control clusters, seed dealers in Ahmednagar are presented as below. In general, this chapter deals and presents the objective wise findings of the study under the following major sections.

4.1 General features of the study area

4.2 Seed requirement, supply and Gap at Macro level in Maharashtra

4.3 The prevailing seed supply chain in the HOPE project clusters and Control area

4.4 The seed replacement rate in Hope and Control area

4.5 The relative economics of informal seed production in Hope area vis-à-vis grain production

4.1 General features of the study area:

Table 4.1 General features of the study area

General Information	Nimblak (HOPE) (%)	Burudgan (Control)(%)
Total Geographical area	2372 ha	1158 ha
Total Operational Holdings	1671 ha	925 ha
Total Population	7240	4627
Total Household	835	617
Per Capita holdings	2.01	1.5
Major Rabi crops area(ha)		
(i) Jowar	965 (58)	365 (40)
(ii) Wheat	45 (3)	200(22)
(iii) sugarcane	35 (2)	85 (9)
Major Kharif crops area (ha)		
(i) Bajra	635 (4)	325 (35)
(ii) Moong	450(27)	225(24)
(iii) Summer Crop area (ha)(groundnut)	45 (3)	55 (6)
Popular varieties of rabi sorghum	Phule Rewati, Vasudha, Suvarna	Maldandi

Figure in paranthesis indicate the % to total operational holdings

The table shows that in 2010-11 the total operational holdings is higher in HOPE area as compared to Control area. The per capita holdings in HOPE area is 2.01 which shows that the majority of the farmers in the area are Large where as in case of Control area it is 1.5 which indicates that majority of farmers in this area are small. Among the rabi crops , sorghum accounts the major share which is around 58% of the total operational holding in the HOPE area whereas it is 40% in Control area. While Moong and Bajra accounts the major share in case of Kharif crops which is around 27% and 4% in HOPE area respectively and around 24% and 35% respectively in Control area. The frequently used rabi sorghum variety in HOPE area are Phule Vasudha, Phule Rewati whereas in case of Control area it is Maldandi.

4.2. Seed requirement, supply and Gap at Macro level in Maharashtra(2011)

Table 4.2 Seed requirement, supply and Gap at Macro level in Maharashtra(2011)

Area (2007-08 to 2009-10) ('000 ha)		4,421
Last 3 Yrs Sale(qtls)		40,320
Total seed Required as per SRR(qtls)		3,53,680
Tentative seed Supplied through different sources (qtls)	MSSC	1923
	NSC	600
	Private	37020
	Total	45543
	GAP (+/-)	(-) 3,08,137
	Seed Replacement Ratio	13 %

The table 4.2 shows that there is a huge gap of 3,08,137 quintals between the requirement and supply of seed in case of rabi Sorghum. Out of the total seed requirement of the seed which is 3,53,680 quintals only 45,543 quintals is supplied by Public sector. Thus, the

Average Seed Replacement Ratio indicated that only 13 % of the area is sown with purchased seed. The remaining 87% of the seed requirement is met through own/farm produced seed from the informal sector.

Table-4.3 Rabi Sorghum Varieties (Dual Purpose) released by Different Agencies in Maharashtra (2007-12)

Varieties released	Unique features	Universities
Parbhani Moti	DR, Short duration	MAU
Phule Yashoda	I,DR, Medium duration	MPKV
Phule Chitra	DR, Short duration	MPKV
Phule Anuradha	DR	MPKV
Phule Rewati	I, DR	MPKV
Phule Panchami	DR	MPKV
Phule Vasudha	I, Medium duration	MPKV

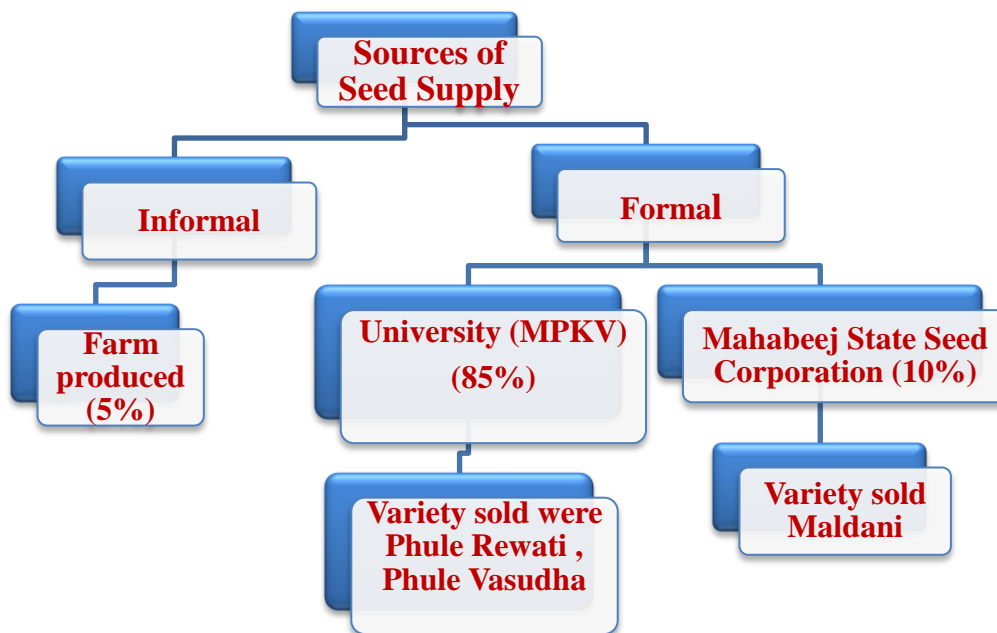
Note: I – Irrigated, DR – Drought resistant

The table 4.3 shows that different improved varieties that have been released so far by the different Universities in Maharashtra during 2007-12. As can be seen from the table that MPKV plays an important role in the distribution of improved varieties of rabi sorghum in Maharashtra. All the varieties that have been released have some unique features. For example varieties like Phule Rewati , Phule Panchami, Phule Chitra , Phule Yashoda are all drought resistant. While Phule Vasudha and Yashoda are medium duration varieties, Phule Chitra and Parbhani Moti are short duration varieties.

4.3.The prevailing seed supply chain in the HOPE project clusters and Control areas:

In the seed business, in order to provide the customers with high-quality products when and where they need them, balancing supply with demand takes careful management. Supply Chain is responsible for making sure that seed is available to meet the market demand and for providing customers with high-quality products that meet their expectations.

Chart 4.1 Supply chain of rabi sorghum seed in Hope area (Nimblak):



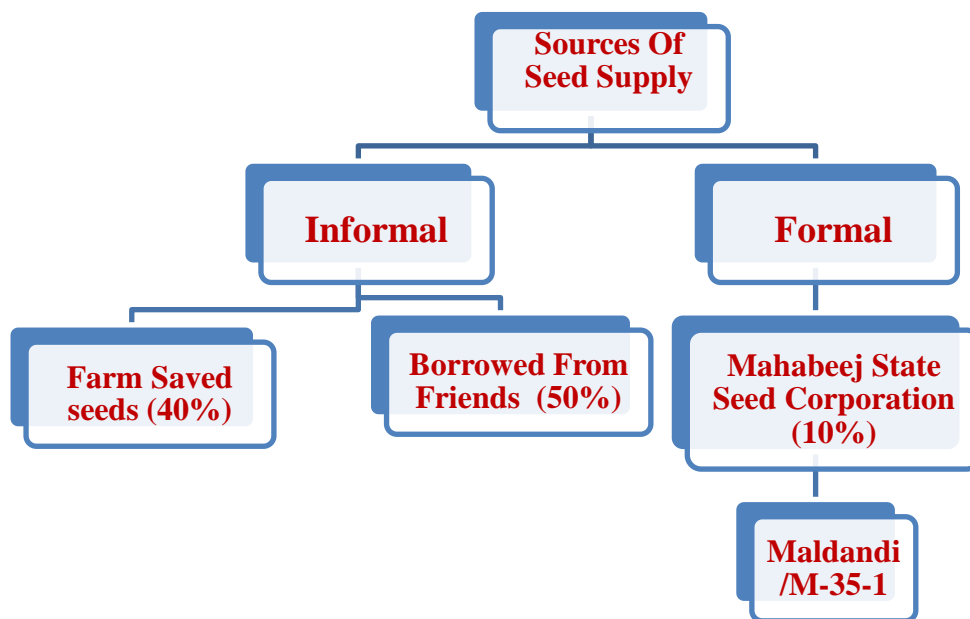
The chart 4.1 shows that in the HOPE Cluster Village (Nimblak), out of the total estimated seed requirement which is around 7720 kg, over 85% is supplied through MPKV. This is mainly because of the HOPE project. Over 10% is supplied by Mahabeej, a state seed corporation. The seed supplied is mainly Maldandi. The farmers in this area use only 5% of the saved seeds as majority of their requirement is met by the University. Out of the total seed requirement, the public sector provided 95%, followed by Informal sector (5%).

4.3.1 Seed Village Program (Nimblak)

The program was started in 2012 in which 54 farmers were selected with an area of 250 ha. The farmers who participated in the program procured Foundation seeds from the MPKV. Around 216 kgs of foundation seeds were distributed at free of cost to the selected farmers. The Sorghum Breeders/Scientists inspected the seed production plots at critical stages right from production to processing, monitored quality controls and facilitated Seed distribution to

different farmers. The total volume of seed produced from 250 Ha is around 3125 qtls. The farmers distributed the seeds produced in the nearby place and sold them at a price of Rs 30/kg.

Chart 4.2 Supply chain of Rabi Srghum in Control area (Burudgaon)



The chart 4.2 shows that out of the estimated total seed requirement which is 3160 kgs, over 40 % are through own saved seeds. Similarly, over 50% of the seeds are received from friends and relatives and only 10 % of the seeds are purchased from the Mahabeej. Out of the total seed used, the share of public sector is around 10%, while the informal is 90%. The farmers in the Burudgaon use large proportion of own saved seeds. The interesting point to note is that these saved seeds are used next year only for fodder purpose. These saved seeds are considered to be very good for animal feed and hence supports allied activities of farmers. For producing grain next year seeds are either borrowed from friends/relatives or purchased from market. The farmers do not use saved seeds for producing grain next year because per unit production falls when the same seeds are used next year. The seeds purchased is mainly Maldandi.

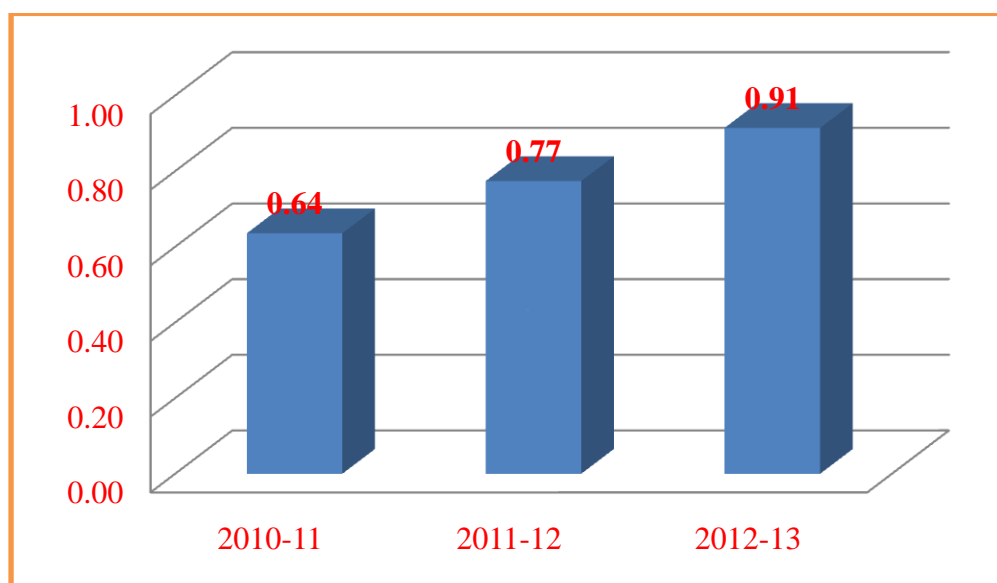
Thus, 95 % of the seeds in the HOPE cluster comes from the formal sector, whereas 90 % of the seed requirement in Control area is met by informal sector. This is due to the fact that in

the control area sorghum is considered as food and fodder crop not cash crop. Secondly, this area has irrigation, hence farmers have more options.

4.4. The seed replacement rate in HOPE and Control area:

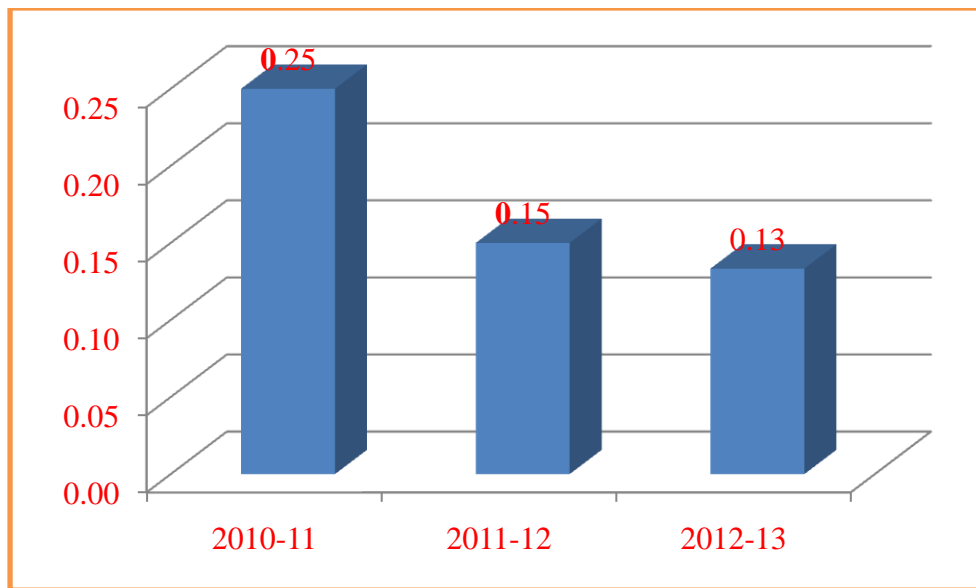
The achieved SRRs in most of the crops in State are ones above the targets fixed at national level. Barring Groundnut crop because of higher seed rate per hectare and cost of seed is not affordable to small and marginal farmers, and in case of Sorghum because of Rabi Sorghum grown in rainfed conditions and weaker financial condition of farmers having less purchase power leads to low SRR. Also farmers use local varieties of Sorghum like Dagadi, Shalu etc. and no superior variety which can replace the most popular drought resistance M-35-1 variety in Maharashtra.

Figure 4.1 Seed replacement in HOPE area.



The figure 4.1 shows the seed replacement rate in Nimblak village which is a HOPE farmer. The farmers in Nimblak village mainly use improved varieties like Phule Vasudha and Phule Rewati. Only a very small proportion of area is used for sowing farm saved seeds. The farmers in this area save only a small proportion of seeds and it is used only for fodder purposes. The farmers in Nimblak started using improved variety in recent years with the introduction of Seed Village Programme. The seed replacement rate in this region increased from 0.77 in 2011-12 to 0.91 in 2012-13.

Figure 4.2 Seed replacement rate in Control areas



The farmers in Burudgaon use only Maldandi and that too for fodder because this area has good irrigation facility and farmers prefer cash crops like wheat, sugarcane etc. for commercial purpose. The figure indicates that the seed replacement rate has fallen from 0.15 in 2011-12 to 0.13 in 2012-13.

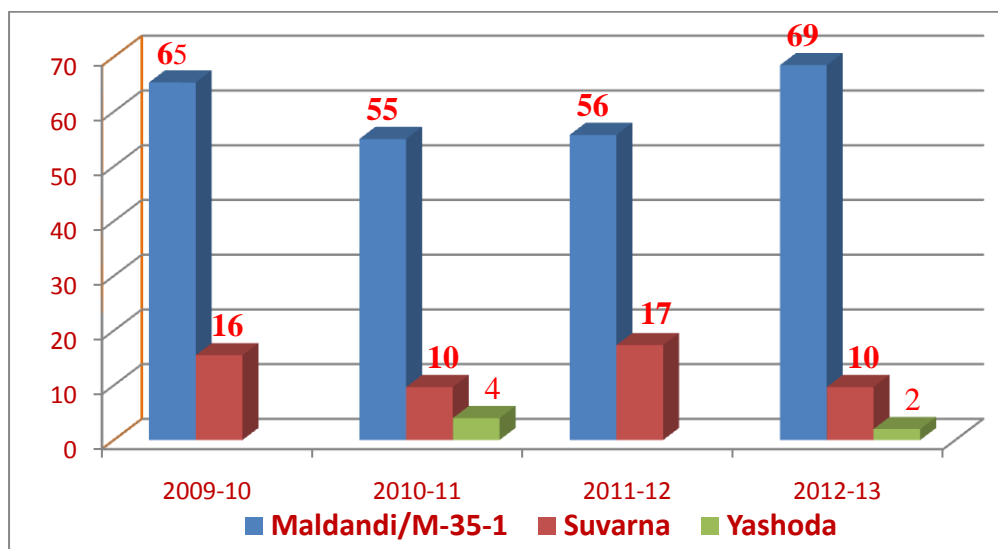
Thus, the seed replacement is low in Control cluster village whereas it is very higher in HOPE cluster because of the HOPE project. The probable reasons for low seed replacement

- i. Low rate of returns to their investments, since sorghum is a food crop
- ii. Lack of effective extension for dissemination of information relating to access and availability of seed
- iii. Low profitability
- iv. Risk and uncertainty-like prolonged drought

4.4.1. Agro Dealers Visited at Nagar:

There are around 14 Agro dealers in the Ahmednagar District Headquarter. The bulk of the seed sold is Maldandi. They procure only the demanded quantities from the Seed Corporation and Private Companies. The following figure shows the quantity of seeds sold by Agro Dealers over the years in the Nagar.

Figure 4.3. Quantity of seed (qtls) sold by Agro-dealers over the years



The figure 4.3 shows that on an average, 69 quintals of Maldandi was sold in 2012-13 followed by Yashoda and Suvarna which is 10 quintals and 2 quintals respectively. Though Yashoda replaced Suvarna in 2010-11 and 2012-13 but the replacement was very small. Out of the 3 varieties sold, Maldandi accounts for 85 % of the total seed sold, followed by Suvarna and Yashoda which is 12% and 5% respectively in 2012-13.

4.5.The Economics of informal seed production, distribution and net margins in Nimblak (HOPE area)

Use of inputs and their cost are important in determining the production efficiency of a farm business. The following table shows the cost per hectare , gross returns and net margins from seed and grain production.

Table 4.4 Economics Analysis of Seed Production, Distribution and Net Margins(Perha)

Particulars	Seed Producer	Grain Producer
Input cost	2,235(11)	1,872 (15)
Labor cost	7,184 (33)	8,114 (65)
Machine cost	12,125(56)	2,497 (20)
Cost of production	21,544	12,483
Post harvest and processing costs	3,938	2,243
Total Cost	25,482	14,726
Main product yield(qtls)	12.5	6.08
value of main product(Rs/qrtl)	3,000	2,380
By product yield(qtls)	47	18
Value of by Product(Rs/qrtl)	400	369
Gross Returns	56,250	21,199
Net Margins	30,768	6,473
Return to cost ratio	2.21	1.44

Figures in paranthesis indicate % to the total

The table 4.4 shows that on an average the production cost per ha of seed production is Rs 21,544 as against grain production which is Rs 12,483. In seed production, out of the total cost of Production, the machinery cost account the major share (56 %), followed by Labor (33 %) and the input cost (11 %) whereas the share of these costs in case of grain production is 20%, 65% and 15% respectively. The reason for high share of machinery cost in case of seed production indicates that machines replace labor in case of seed production. Also, the value of main product in case of seed production is Rs 3,000 per quintal which is higher than that for grain production which is Rs 2,380 On average, after accounting all the cost the net margin per ha in seed production is to the tune of Rs 30,768 as against grain production which is Rs 6,473. The reason for high net returns in case of seed production is that the seeds fetch high price in the market when compared to grain. The return to cost ratio indicated that for every rupee of expenditure on seed production, it has generated a net income of Rs. 2.21

as against Rs1.41 in case of grain production. Thus seed production is relatively more profitable than grain production.

Chart 4.3 Proportion to total cost of Seed Production

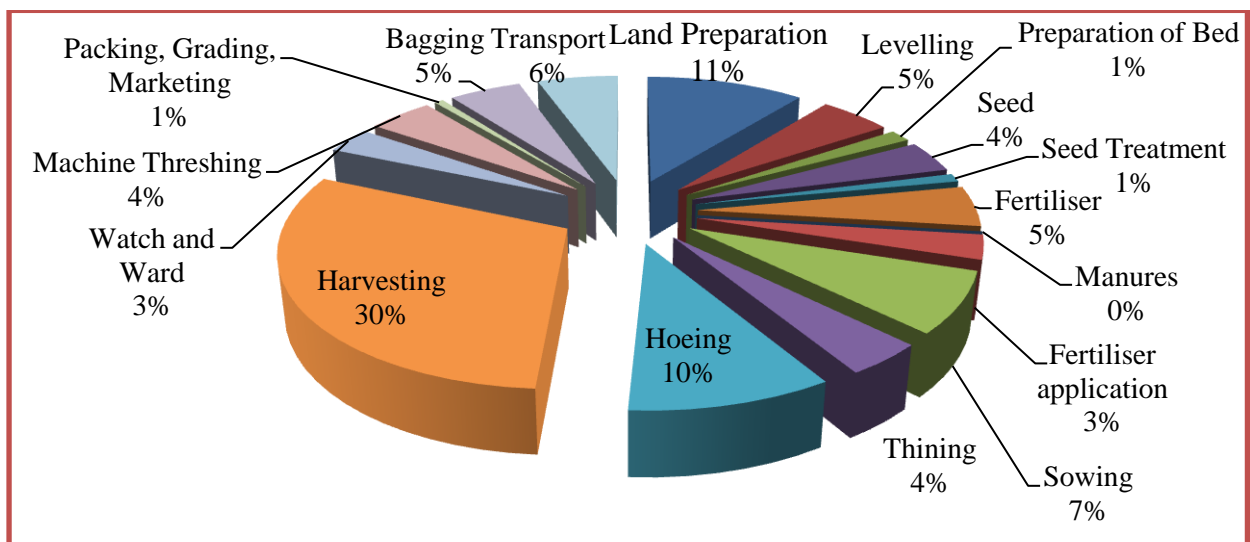
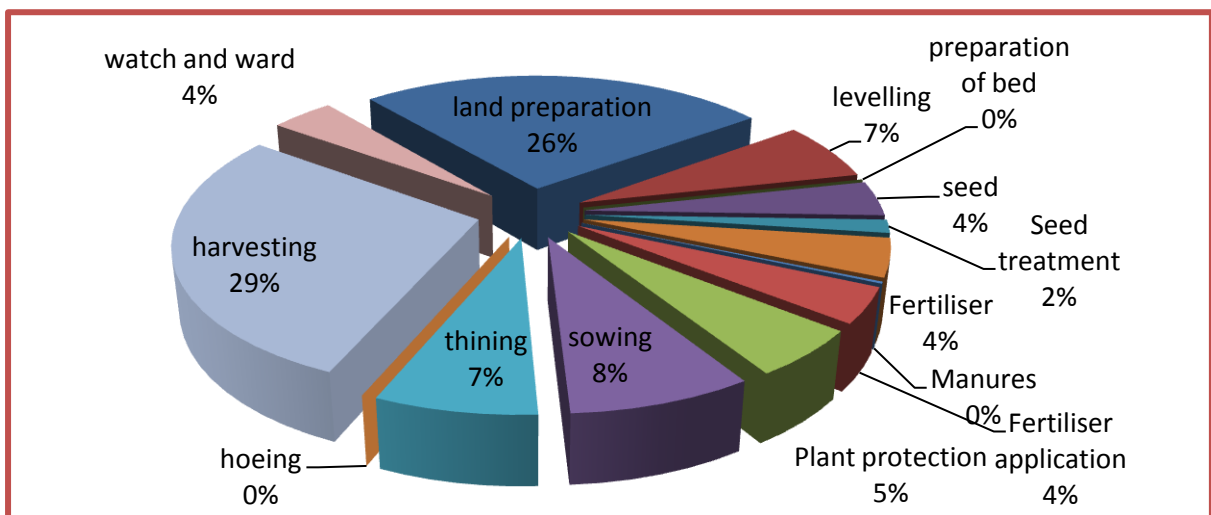


Chart 4.4 Proportion to total cost of Grain Production



Charts 4.3 and 4.4 show the cost of individual practice of seed and grain production . In case of seed production, harvesting (30%) , land preparation(11%) and hoeing(10%) account the major share among all the other practices. While the share of harvesting , land preparation and sowing is 29%,26% and 8% respectively. The share of hoeing is almost negligible in case of grain production. Thus, due to the use of many practices in seed production , the cost per hectare of seed production is more than grain production.

Table 4.5 Incremental Cost-Benefit Analysis of Seed and grain Production (2012-13)

Particulars	Seed Production
Added Main Product Yield (kgs) (Main product yield of seed producers – grain producers)	642
Added By-Product yield(kgs) (By-product yield of seed producers – grain producers)	2900
Added cost (Rs) (Cost of seed production – Cost of grain production)	11,116
Added Returns (Rs)	30,860
Incremental Cost Benefit Ratio	2.78

The table 4.5 shows the incremental cost benefit analysis. The main reason of increasing farmer's preference for seed production is the added yield per hectare from it when compared with grain. In the above case this difference is 642 kgs. Though the added cost per hectare from seed production is Rs 11,116 but this cost is overcome by added returns per hectare which is Rs 30,860. The incremental Cost to Return ratio indicated that for every rupee invested on seed production, it has yielded an incremental return of Rs. 2.78 reflecting the profitability of seed production over grain production. This is mainly because of intensive cultivation by applying all the inputs. The productivity of grain and fodder is very high. Hence, the seed production is more lucrative than grain production.

5. CONCLUSION AND IMPLICATIONS

This study adds to a growing literature about the interactions between formal and informal seed channels. In the areas surveyed of Maharashtra, the environment is marginal for crop growth. The results of the study conducted shows that most of the seed requirement of farmers is met through informal sector except in HOPE clusters. There is huge gap between seed requirement and supply of post rainy sorghum. The improved varieties are available with Agro dealers but there is less demand for it because of the use of traditional or local varieties by farmers. Barring HOPE cluster, both at macro and micro level the seed replacement ratio is very low because of the less area under improved varieties of post rainy sorghum. In seed production, out of the total cost of Production, the machinery cost account the major share (56 %) whereas in case of grain production major share is occupied by labor cost(65%). The seed production is advantageous to grain production with higher net margins to farmers.

The seed village programme concept should be introduced on large scale as was started in Nimblak village of Maharashtra. Production and supply of quality seeds of the crops require highly technical know-how, trained personnel and independent resources. The following factors are to be addressed immediately: (i) lack of knowledge among the hybrid seed producers, (ii) improper coordination between various seed producing associations, (iii) lack of an industry watchdog for remedy of problems. More farmers need to be trained to undertake seed production since it is profitable compared to grain production. Farmers groups need to be trained (Capacity building) to undertake seed production. These groups should be linked to federations like Mahabeej State Seed Corporation (MSSC). The Current challenges facing the seed sector in the marginal environments of India is the extent and persistence of farm-saved seeds. The extent and continued use of farm-saved seeds especially in case of post rainy sorghum discourages the entry of commercial sector in developing new research products and also from the perspective of public sector to add any kind of incentives for their already existing research. Though farm-saved seeds promote the use of local or traditional varieties to some extent thus conserving the land races, over time it doesn't provide adequate choices to the farmers to diversify their portfolio and thus improving productivity.

REFERENCES:

Economics of vegetables seed production and marketing-An analysis of contract farming in Karnataka., 2004, N.,Nagaraj , R.,Prathima, M.G Chandrakanth,.and S.V., Ramani

Indian Seed Sector : The Way Forward, 2013, Raj . S.Paroda .

Village seed systems and the biological diversity of millet crops in marginal environments of India, 2006 , I. Nagarajan and Melinda, Smale.

Sorghum: Vision 2030,Directorate of Sorghum Research, Rajendranagar, Hyderabad 500 030 (AP), India. ,38 pp.,2011, Correct citation : Vilas A Tonapi, JV Patil, B Dayakar Rao, M Elangovan, B Venkatesh Bhat and KV Raghavendra Rao.

Improving post-rainy season sorghum productivity in medium soils: does ideotype breeding hold a clue?, March 2012, P.S., Reddy,J .V., Patil,S.V.Nirmal, and S.R. Gadakh

Adoption of Improved Sorghum and Millet Cultivars in SSA , January 6, 2010, Jonathan. Armah, Marieka . Klawitter, Anderson, and. Leigh . C

The Role of Varietal Attributes on Adoption of Improved Seed Varieties. The Case of Sorghum in Kenya, August 12-14, 2012 , Anne G. Timu , Richard M. Mulwa, Julius Okello, Mercy Kamau .

Biotechnology And Sustainable Agriculture:Lessons From India, OECD Development Centre , Working Paper No. 103,(Formerly Technical Paper No. 103), December 1994, Ghayur Alam.

The role of national seed policies in re-structuring the seed sector in CEEC, CIS and other Countries in Transition - Michael Turner

Private-Public Sector Partnerships in the Seed Industry, APSA TECHNICAL REPORT NO. 44 , Asian Seed 2006. Mogens Lemonius.

Enhancing seed replacement rate for ensuring food security in SAARC countries, : Dr. Md. Nazmul Huda.

Current Status And Strategy For Promoting Hybrid Sorghum And Pearl Millet Technology, C.T. Harh, Jr.

Public-Private Sector interaction in the Indian Agricultural Research System: An Innovation Systems Perspective on Institutional Reforms, Published in Byerlee, D. and R.G.Echeverria(eds)2001, Andrew Hall, Rasheed Sulaiman V, Norman Clark , M.V.K . Sivamohan and B. Yoganand.

History Of Seed Production And Its Key Issues , International Journal of Food, Agriculture and Veterinary Sciences ISSN: 2277-209X (Online) An Online International Journal Available at <http://www.cibtech.org/jfav.htm> 2013 Vol. 3 (1) January-April, pp. 148-154/, T.C.Poonia

Sorghum Seed Production and Distribution , Sorghum In The Eighties, Volume International Crops Research Institute for the Semi-Arid Tropics, 2-7 November 1981, K. R. Chopra.

Why Informal Seed sector is important in Food Security, African Technology Policies Studies Network, Biotechnology Trust Africa, Special Paper Series No. 43, Joseph M. Wekundah.

Changing Seed Policy, Law and Regulation: An appraisal of The Emerging Seed Markets in Andhra Pradesh, GAPS Series Working Paper : 6, June 2005, E Revathi, R V Ramana Murthy

Local Markets, Local Varieties, Rising Food Prices and Small Farmers' Access to Seed, IFPRI Issue Brief 59 February 2009, Melinda Smale, Marc J. Cohen, and Latha Nagarajan.

Minor Millets In India, IFPRI Issue Brief 59, February 2009, Latha Nagarajan, Melinda Smale, and E. D. I. Oliver King.

Economic Survey of Maharashtra , 2012

Presentation on “National Conference on Agriculture Rabi Campaign 2011”
MAHARASHTRA

Understanding the Seed Industry: Contemporary Trends and Analytical Issues, August 2002,
Bharat Ramaswami

Seed Diversity in The Dry lands: Women And Farming In South India, Gatekeeper Series
126, 2006, Carine Pionetti

Seed System Innovations in the Semi-Arid Tropics of Andhra Pradesh, January 1,2007, Ch
Ravinder Reddy, Vilas A. Tonapi, P. G. Bezkorowajnyj, Srishail Sharanappa Navi, N.
Seetharama.