Department of Agricultural Marketing,

Co-operation and Business Management

University of Agricultural Sciences, Bangalore

Project Report

Maize Business School

Project funded by

CCS National Institute of Agricultural Marketing (CCS NIAM), Jaipur, Rajasthan

2020

ISBN: 978-81-943252-8-4

Maize Business School – Project Report

Project Team:

Dr. C.P. Gracy
Dr. Sathyendra Kumar. A. D
Dr. M.S. Ganapathy
Dr. Siddayya
Dr. Ranganath. G
Mr. Somaiah. K.P
Mr. Raghavendra. P.K

Published by:

CCS National Institute of Agricultural Marketing (CCS NIAM)

(An Autonomous Organization of Ministry of Agriculture and Farmers' Welfare, GoI)

Kota Road, Bambala, Pratap Nagar, Jaipur-302033, Rajasthan, India

Phone:0141-2795104

Email-Id: dgccsniam@gmail.com

Website: www.ccsniam.gov.in

Department of Agricultural Marketing,
Co-operation and Business Management
University of Agricultural Sciences, Bangalore

Project Report

Maize Business School

Project funded by

CCS National Institute of Agricultural Marketing
(CCS NIAM), Jaipur, Rajasthan

2020

डॉ. पी. चन्द्रा शेखरा
महानिदेशक

Dr. P. Chandra Shekara
Director General

MESSAGE

Kisan Business School (KBS) initiated by CCS National Institute of Agricultural Marketing, Jaipur is focusing at transforming Agriculture to Agri-business by inculcating best Agri- business practices to farmers through Capacity Building and constant mentoring by expert institutions such as Agricultural Universities, KVKs, Agri- business Companies, NGOs, etc. The aim of KBS is to enhance the income of the farmers by adopting recommended scientific practices and utilizing fullest use of developmental programmes of Government.

Maize Business School (MBS) was initiated under KBS in Karnataka in collaboration with University of Agricultural Sciences (UAS), Bangalore, which aimed at identifying and managing critical stages in maize production for augmenting farm income. The project team has examined all the aspects of Maize cultivation in business dimension. Primary impact study shows that MBS increased Maize Productivity and profits, Intermediate outcomes include improved knowledge and capacity of farmers, adoption of new approaches and exposure to new techniques while managing maize farming. The project team deserves compliments for this achievement.

I hope this project would make a significant contribution for transforming Maize cultivation to Agri-business and serve as a road map for Doubling Farmers Income. I would like to compliment CCS NIAM and UAS-B teams for successfully completing the project with several tangible and non-tangible benefits to farmers.

October 28, 2020

(P. Chandra Shekara)

सीसीएस राष्ट्रीय कृषि विपणन संस्थान (नियाम), कृषि एवं किसान कल्याण मंत्रालय, भारत सरकार का संगठन
CCS National Institute of Agricultural Marketing (NIAM), An Organisation of Ministry of Agriculture & Farmers Welfare, Govt. of India
Kota Road, Bambala, Sanganer, Pratap Nagar, Jaipur, Tel.: 0141-2770027 Fax : 0141-2771938, Mobile : 9848308111
Email : dgccsniam@gmail.com, Website : www.ccsniam.gov.in

Dr. S. Rajendra Prasad
Vice Chancellor
UAS, Bangalore

MESSAGE

I deem it an honour to express my viewpoint for an ambitious and farmer centric project funded by national level premier business school CCS-NIAM, Jaipur. Maize Business School project has been designed as a perfect launch pad for those farmers who want to improve their farm business knowledge and decision-making skills and change attitude towards commercialization of farming. The concept of business school is most appropriate from the point of view of doubling farmers' income, enhancing sustainable production, marketing and value addition.

Maize Business School is a unique project where the farmers spend a year with project team where interactive programmes are designed to support farmers who require guidance for efficient production and marketing. It is of interest to note that novel approach is adopted in the operationalization of the project. This made possible by adopting the high-quality training and facilitation with constant monitoring and communication.

I am happy to know that CCS-NIAM is publishing e-book of Maize Business School carried out in Karnataka. May the developing country like India make the best use of these innovative idea of project to shape future farming and farmers future. Hearty congratulations and best wishes.

October 2020 **(S. Rajendra Prasad)**

Dr. Y.G. Shadakshari
Director of Research
UAS, Bangalore

MESSAGE

There is a considerable convergence of thinking between the University of Agricultural Sciences, Bangalore and CCS-NIAM on major trends, drivers, challenges of agriculture. The university has open eye towards apt basic and strategic research collaboration altogether in attaining livelihood security of the farming community, besides scientific advancement in the field of agriculture. Thus, the collaborative research project on Maize Business School funded by CCS-NIAM has been successful in achieving its goals.

It gives me immense pleasure to pen my thoughts on this novel initiative of transitioning farming with business acumen. Although there are efforts in providing business bent of mind to farmers through technological support by way of extension, a holistic and consistent effort of hand holding farmers from seed to plate is need of the hour. Even a bountiful harvest doesn't assure profits to farmers unless a good marketing mechanism is put in place. In this context the MBS project sponsored by CCS-NIAM is first of its kind.

The MBS performance with benchmark indicators have been promising. Identification of critical stages in maize and suitable agronomic practices could enhance yield and quality of the produce. The project team has focused on production, marketing and value addition aspects by constant monitoring and interaction with farmers.

I am happy that CCS- NIAM is bringing out the project output in the form an e-book for the benefit of farmers and researchers. I wish the book will serve as a valuable resource material for such ventures in future.

October 2020 **(Y.G.Shadakshari)**

ACKNOWLEDGEMENT

The project entitled "Maize Business School" was funded by Choudary Charan Singh - National Institute of Agricultural Marketing (CCS-NIAM), Jaipur, Government of India. The research team is grateful to Director General, NIAM, for providing the inspiration, support and guidance for completing the innovative project aimed at enhancing farmers' income, sustainability, nutritional security and business acumen.

We express our gratitude to the Hon'ble Vice Chancellor University of Agricultural Sciences, Bangalore (UASB), Director of Research, Coordinator of PPMC and the Registrar UASB provided their consistent support in creating an MOU between UASB and CCS-NIAM

The team would also like to express their heartfelt thanks to Mr. Sathyendra, nominated Project Co-ordinator from CCS-NIAMfor his constant support, encouragement and liaising project team of UASB with CCS NIAM. Further, wholehearted thanks to theCCS NIAM members of faculty and students for contributing to fine-tune the report by way of suggestions during the final presentation of the report. The members of faculty, postgraduate studentsand staff of the Department of Agricultural Marketing, Co-operation and Business Management, UAS, Bangalore are gratefully acknowledged for providing their constant support, valuable suggestions and help. The Co- PI's of the project have been extremely vibrant and provided necessary support to launch into success.

This opportunity would be apt to acknowledge the valuable suggestions made by fellow faculty members of UAS who were involved in providing necessary impetus to the project success. Senior Research Fellows of the project for their hard work and commitment in completing this project. Special thanks to Messrs Mallikarjuna and Kanakaraj for editing the video documentation.

We place on record the financial support from CCS-NIAM for sanctioning this research study without which it would not have been possible. Finally, we would like to place on record the officials of the Karnataka State Department of Agriculture (Davanagere), Mr. Sachin from Roots Goods company and participant farmers for their involvement at different stages of the project.

Abstract

Maize Business School (MBS) project on the lines of Farmers Field School (FFS) Model of FAO, funded by CCS-NIAM is carried out in Guddadabenakanahalli village of Chennagiritaluk, Davanagere District. More than 75 per cent of the cultivated rainfed area in the village is occupied by maize crop. Twenty-five (25) sample farmers were selected as project participants from the village after conducting general meeting with villagers. The main focus of MBS was identifying and managing critical stages in maize production for augmenting farm income. Regular meetings, personal interactions and constant communication with the selected farmers enabled in scientific management of maize production at critical stages. The consistent efforts have increased average yield by 2.89 qtl per acre from the benchmark yield of 16.87qtl/ac and decreased cost of production by ₹158/qtl through proper management practices as compared to before the MBS implementation. Income benchmarking of 25 farmers in the study area was accomplished by taking triennium average for 2016 – 18 period. Later the yield obtained during project implementation period (2019) was compared with the benchmark to know the impact. Marketing assistance was given to farmers by linking with maize traders to ensure that farmers get better prices for maize. An average increase in income was ₹7,111 per acre with the MBS project. Considering the fact that on an average about 3.50 acres of maize is cultivated by sample households, the magnitude of additional income is notable. The MBS primary impact on economic outcomes was twofold viz., increased maize yield (production per unit of land) and profits (revenue minus cost), Intermediate outcomes include improved knowledge and capacity building of farmers, adoption of new approaches (including reduced pesticides use) and exposure to new techniques while managing maize production.

CONTENTS

EXECUTIVE SUMMARY

Maize Business School (MBS) project on the lines of Farmers Field School Model of Food and Agricultural Organization (FAO), Rome, Italy is funded by CCS-NIAM, Jaipur during 2019-20 agricultural year. The project was implemented in Guddadabenakanahalli village of Chennagiri taluk, Davanagere district. The MBS benchmarked previous production and marketing practices of maize farming to identify critical stages in maize production and equip farmers with knowledge and skills to transform maize farming into a business proposition.

25 maize farmers who were enthusiastic to participate in MBS by adopting all the recommended practices and co-operate with the team were selected as project beneficiary. The primary data were collected from maize growers using pre-tested structured schedule. Majority (60 %) of the maize growers in the project area belonged to the age group of 31-50 years, followed by age groups of above 50 years (24 %) and up to 30 years (16 %). With regard to education level of maize growers, 56 per cent of them had education up to primary school, followed by those with no formal education (24 %), High school (12 %) and PUC (8 %). Majority (84 %) of the families of maize growers were joint in nature while the rest (16 %) had nuclear families. Agriculture was the main occupation among all the sample maize growers. The average farm size of sample farmers was 5.87 acres. About 82.62 per cent of the farm was dry land followed by irrigated land (17.37 %). The average area under maize cultivation of MBS farmers was 3.59 acres during the base year there was an increase of 0.24 acres under maize cultivation in 2019-20period due to early on set of south-west monsoon.

The aim of MBS was to train farmers for adoption of improved production and management practices. Therefore, training programmes/ workshop/ discussion meetings on different aspects of production, management and value addition were organized. The training programme covered various topics on production practices in maize such as land preparation, fertilizer and micro nutrient and bio-fertilizers application, quality seeds, seed treatment, sowing, inter-cropping in maize, management practices for itch grass weed and Fall Army Worm (FAW) control techniques and value addition of maize. The farmers were linked with buyers who proposed to use block chain technology. All the sample farmers used hybrid seeds of different companies for maize production. Brand distribution of maize seed

constituted CP (45 %), Dhanya (40 %), Aditya (10%) and Proline (5%). Important critical stages were identified in maize production and timely management practices were suggested with respect to split application of nitrogenous fertilizers, FAW control and cultural operations. The concept of blockchain for marketing of maize was also briefed by the concerned officers of supply logistic company.

The study examined the changes in outcome indicators, such as farm income and quantities of maize produced, cost of cultivation before and after MBS participation. In order to derive a comparable measure of change in outcome indicators among MBS farmers, the relevant data were collected from farmers for computation of cost of production of maize. Before MBS implementation the cost of production per quintal of maize was ₹ 1450/qtl, on the other hand after MBS implementation cost incurred in production of maize was ₹ 1292 /qtl. Cent percent of MBS farmers reported experiencing positive changes in farm income from MBS participation. The average yield per acre for the year 2018-19 was 16.87 qtl and after implementation it was 19.79 qtl for the year 2019-20, thus accounting for an average increase in yield of 2.89 qtl/acre. The average income from maize after MBS participation was ₹ 32,870 per acre i.e. increase of ₹ 7,111 per acre for the year 2019, in comparison to past three years average income of ₹ 25,759 per acre. Across all outcome indicators, majority of the MBS farmers experienced substantial changes in the productivity of maize. This is attributed to use of hybrid seeds recommended by subject matter specialist and adopting good management practices. Considering the fact that on an average about 3.47 acres of maize is cultivated, the net incremental income is substantial.

Impact evaluation observed that seventy-nine per cent of target farmers being completely satisfied with MBS facilitation, while 14 per cent indicated to have been somewhat satisfied, and the rest were mostly satisfied. In terms of implementation, 67 per cent indicated they were completely satisfied with MBS implementation, while 21 per cent were somewhat satisfied, and the rest were mostly satisfied. Majority of sample farmers indicated that all the training programs conducted were highly useful.

The primary outcome of the project is impact on economic outcomes, including maize yields, profits, networking and household utilization of maize. Intermediate outcomes include improvement in knowledge and capacity of farmer, adoption of new approaches like reduced pesticides use and practice of book keeping for tracking income and expenditure.

1 INTRODUCTION

Maize is globally a top-ranking cereal not only in productivity but also as human food, animal feed and as a source of raw material for a large number of industrial products. The potential for enhanced use of maize for value added products for human consumption to meet the needs of future generation provides the researchers with unique challenges and opportunities. Maize, considered as queen of the cereals is the third most important cereal crops in the world, next only to rice and wheat. In India during 2017-18, the area, production and productivity of maize were 7.434 Mha, 20.118 Mts and 2706 kg/ha, respectively. In Karnataka during 2017-18, maize was grown in an area of 1.31 Mha with the production and productivity of 3.853 Mt and 2869 kg/ha, respectively. Globally major portion (55 %) of maize is consumed as food (55%) used as feed, forage starch and ethanol production. Broadly, Karnataka, Andhra Pradesh, Uttar Pradesh, Bihar and Madhya Pradesh are the major producers of maize in India. Karnataka ranks first in maize in India and contributes 10 per cent to overall production. In Karnataka, maize can be grown throughout the year in view of the favourable agro-climatic condition. However, maize is mainly cultivated as a rain fed crop in Kharif season in Davanagere, Belgaum, Bellary, Chitradurga, Dharwad, Hassan, Chamarajanagar and Haveri Districts.

The concept of Farmer Business School (FBS) was developed to build capacity among farmers to improve their farm business knowledge and decision-making skills, and to change attitudes towards commercialization. FBS, like Farmers Field School (FFS), are characterized by a focus on adult and experiential learning (“learning by doing”), group-based and participatory approaches, facilitation rather than structured teaching, and capacity building and long-term engagement with farmers. Both FFS and FBS have been likened to models such as farmer-to-farmer extension, farmer-centred extension, and participatory extension approaches. However, there are important differences between the FBS and FFS approaches. While FFS focus on crop production and addressing technological constraints on the farm, promoting environmentally sustainable management practices and productivity increase, FBS focuses on marketing, entrepreneurial and management skills (FAO, 2011).

The FBS is an interactive program designed to support smallholder farmers who require guidance for efficient production and marketing. The aim is to increase the capacity of farmers to manage their farms effectively and increase their profitability. Some organizations have combined these into Farmer Field and Business Schools (FFBS), while others have developed variants of FFS or FBS which include modules on nutrition, gender

equality or group formation. FBS are implemented over multiple years, beginning with the adaption or modification of existing modules by the implementing organization, followed by training of Master Trainers. These Master Trainers are ultimately responsible for training the district-level trainers, who serve as the facilitators of the FBS at the farmer level. Training and facilitation with farmers usually lasts one year, starting before the planting season and continuing through a full cropping season.

This report illustrates the Maize Business School (MBS) concept, a year-long group-based learning approach aimed at equipping farmers to make better agricultural production decisions towards enhanced productivity and the farm income. The MBS concept stems from the Farmer Field School (FFS) concept developed by the Food and Agriculture Organization (FAO) of the United Nations, which was initially used to promote Integrated Pest Management (IPM) in Asia during 1990s and is now being used in numerous countries. MBS aims to provide farmers with knowledge and skills in market-oriented farm business planning and management through a "learning by doing" approach.

From a methodological perspective, this study showcases the use of mixed methods, combining both qualitative and quantitative techniques to ensure no selection bias and minimize unobserved heterogeneity.

The broader objective of the project is to improve the income of maize growers through critical interventions on practices followed in maize production through monitoring and linking to prospective markets.

1.1 Specific objectives of the project

1. To identify critical stages of maize farming and required technological interventions
2. To develop technological packages for the identified critical stages that can improve production and productivity
3. To identify potential markets for better price and suggest linkages
4. To improve maize grower's income through development interventions and also linking with markets

1.2 Limitations of the project

1. Guddadabenakanahalli is located at a distance of 200 km from UASB, GKVK Campus which constrained frequent personal presence at the project site.
2. Farmers are accustomed to receiving subsidized or free inputs from Government departments and schemes who had similar expectation from MBS too; therefore, changing their mindset required considerable discussion.
3. Global pandemic (Covid-19) coincided with the marketing period leading to curbs on long distance transport and consequent fall in demand for maize.
4. Conflicts arising from cultural bias and other personal issues in the village affected participation in meetings.
5. Due to short duration of the project retention of concepts and practices by participating farmer could not be fully ensured for post project period.

2 METHODOLOGY

2.1 Study area

Maize is grown in almost all the districts of Karnataka owing to increasing demand from feed and starch industry. As on 2018-19 the total area under maize in Davangere was 1,83,135 hectares with a production of 7,82,310 tonnes. Guddadhabenakanahalli village of Channagiri taluk was chosen for the MBS project implementation, because of more area under maize cultivation and the taluk receives assured average annual rainfall of about 800 mm.

Fig. 1: Map depicting project site

2.2 Selection of sample farmers for MBS

Initially the study team comprising of scientists and researchers visited the Joint Director of Agriculture, Davanagere and had an extensive discussion about the production, productivity, soil, climatic condition, rainfall pattern, area under maize cultivation, major pests and diseases incidence in the area. It was suggested to select Guddadhabenakanahalli village as project site.

As per project mandate, The study team further proceeded to Guddadabenakanahalli village in Channagiri Taluk, Davanagere along with the Agriculture officer of the region and had discussion with villagers for the selection of the sample respondents comprising of small, medium and large farmers. Simple random sampling procedure was employed to select the sample farmers. Totally 25 farmers were selected for the study who were enthusiastic to participate in MBS by adopting all the recommended practices and co-operate with the team. The primary data were collected from maize growers using pre-tested structured schedule.

Plate 1: General meeting with the villagers and officers

3.Village and sample farmers profile

Guddadabenakanahalli village is under the jurisdiction of Nilogallu Gram Panchayath, Channagiri taluk, Davanagere district. The total geographical area of the village is 937 hectares, out of which cultivated area is 419.20 ha (44.74 %) and area not available for cultivation was 163 ha. Out of the total cultivated area, maize accounted for about 68 per cent, followed by areca nut (18.18 %), ragi (8.16 %) and banana (4.08 %).

Table1: Land use pattern of Guddadabenakanahalli

Sl. No.	Land type	Area (ha)	% of cultivated area
1.	Total geographical area	937.00	
2.	Cultivated area	419.20	
3.	Forest land	254.00	
4.	Permanent pastures and grazing land	100.80	
5.	Area not available for cultivation	163.00	
6.	Rainfed area	322.20	76.86
7.	Irrigated area	97.00	23.13
Crops			
8.	Maize	284.50	67.87
9.	Areca nut	76.20	18.18
10.	Ragi	34.20	8.16
11.	Banana	17.10	4.08
12.	Red gram	3.30	0.79
13.	Chillie	2.10	0.50

Source: Revenue Department, Davanagere

3.1 Village profile

There were 213 households in the village comprising of 1029 members, out of which, female population constitutes 49.5 per cent which is on par with the national average. Village literacy rate is 56.2 per cent which is far below the state average of 75.36 per cent, this indicates scope for increasing formal education to members of the households (Table 2). In the village, the total working population accounts for about 48.80 per cent meaning that the

remaining 51 per cent of the population has to be taken care by the working population. This shows a high dependency ratio (1:1.05).

Table 2: Village profile of MBS project area

Sl. No.	Parameter	Values
1.	Total Population (Number)	1029
2.	Total Houses (Number)	213
3.	Female Population (%)	49.50
4.	Male Population (%)	50.50
5.	Literacy rate (%)	56.20
6.	Scheduled Tribes Population (%)	0.10
7.	Scheduled Caste Population (%)	90.80
8.	Working Population (%)	48.80
9.	Other category population (%)	9.10

Source: Censusindia.gov.in

Agriculture and water source

It is observed that maize and ragi were the primary crops grown by farmers in the project area for their livelihood. In addition, farmers were also cultivating other high value crops like areca nut and red gram as commercial crops. Rainfall is the main source of water for raising crops. Open well, hand pump and bore wells are the subsurface sources of water for drinking and irrigation. Water bodies such as check dams and ponds served as minor sources of irrigation

3.2 Socio-economic characteristics of maize growers

The sample for MBS comprised of 25 farmers from Guddadabenakanahalli who are regular growers of maize in the locality. This indicated that most of the maize growers had fairly adequate experience in farming activities. The socio-economic characteristics of maize growers are presented in Table 3. It can be observed from the table that 50 per cent of the maize growers belonged to the age group of above 31 to 50 years, followed by age groups of above 50 years (24 %) and up to 30 years (16 %).

With regard to education level of maize growers, a little more than half (56.00 %) of the farmers had studied up to primary school level, while close to 1/4thwere illiterates (24.00

%) which is a cause for concern especially in adoption of new technology eight per cent of the respondents had education up to PUC level and none had degree among the sample farmers. Thus, the educational qualification of the respondents in general could be considered as poor from the point of view of reading and writing skills. Nevertheless, education is regarded as a decisive factor in determining the economic prosperity.

Majority (84.00 %) of the sample maize farmers belonged to joint family type while the rest (14.00 %) had nuclear families. The phenomenon of nuclear family which is the order of the day in the present-day modern world in urban areas has not percolated into the sample households as endorsed by the findings of the present study. The average family size of the sample farmers was about seven comprising of three adult males, two adult females and two children.

Agriculture was the main occupation for cent percent (100 %) of the sample respondents. In Guddadabenkanahalli, in addition to Agriculture, Animal husbandry is an important activity among farm households. This may be due to non-availability of off- farm employment due to low educational status and lack of local industries in nearby towns.

Table 3: Socio-economic characteristics of maize growers

Sl. No.	Particulars	Number	Per cent
1.	**Age (years)**		
	a. Up to 30	4	16.00
	b. 31 to 50	15	60.00
	c. Above 50	6	24.00
	Total	**25**	**100**
2.	**Education level**		
	a. Illiterate	6	24.00
	b. Primary school	14	56.00
	c. High school	3	12.00
	d. PUC	2	8.00
	e. Degree	0	0.00
	Total	**25**	**100**
3.	**Family type**		
	a. Nuclear family	4	16.00
	b. Joint family	21	84.00
	Total	**25**	**100**
4.	**Family composition (Nos.)**		
	a. Adult male	3*	36.07
	b. Adult female	2*	33.93
	c. Children	2*	30.00
	Total	**7***	**100**
5.	**Main Occupation**		
	a. Agriculture	25	100.00
	Total	**25**	**100**

Note: * rounded-off averages

Land holding pattern

The land holding pattern of maize growers is presented in Table 4. The average farm size of maize growers was 5.87 acres. About 82.62 per cent of the farm was dryland and irrigated land was 17.37 per cent. In the study area, the main source of water for agriculture is rainfall.

Table 4: Land holding pattern of Maize sample farmers

(n=25)

Sl. No.	Particulars	Area (acres)	Per cent
1.	Dryland	4.85	82.62
2.	Irrigated land	1.02	17.37
Total		**5.87**	**100.00**

Livestock possession of sample farmers

The livestock possession of maize growers is presented in Table 5. In addition to agriculture, the sample farmers also reared cattle and poultry. The average flock size of poultry was five birds and cattle herd size were three in number. The number of livestock (cattle and poultry) reared by sample farmers was very meagre. The maize growers reared desi breed of cows (Hallikar breed) both for subsistence and agricultural purpose while they raised sheep and poultry for domestic use**.**

Table 5: Livestock possession of sample farmers

(n=25**)**

Sl. No.	Particulars	Number
1.	Cattle	3*
2.	Poultry	5*
3.	Sheep	3*

Note: * rounded-off average

Maize based cropping pattern

Farmers in Guddadabenakanahalli predominantly cultivate maize in kharif season mixed with pulses. The cropping pattern of the maize growers is shown in Table 6. On an average the highest area allocated to maize cultivation accounts for 61.15 per cent of the total cropped area, followed by areca nut (22.14 %) and ragi (12.43 %) and pure crop of red gram accounted for about 4.25 per cent share.

Table 6: Cropping pattern of the maize growers

(n=25)

Sl. No.	Crops	Average area (acres)	Percentage to total	Average productivity (qtl/acre)
1.	Maize	3.59	61.15	19.76
2.	Red gram	0.25	4.25	1.00
3.	Ragi	0.73	12.43	6.50
4.	Areca nut	1.30	22.14	7.00
Total		**5.87**	**100.00**	

4. Implementation of Maize Business School

The aim of MBS is to train farmers for adoption of improved production and management practices. Therefore, training programmes/ workshop/ discussion meetings on different aspects of production, management and value addition were organized.

4.1 Training programme on production practices in maize

Training programme was organized by inviting the subject matter experts pertaining to improved cultivation practices in maize. The subject matter covered comprised of land preparation, fertilizer and micro nutrient application, quality seeds, seed treatment, sowing, inter cropping in maize, conventional weed and pest control techniques and proper harvest of maize.

Plate 2: Training on production management practices in maize

Field preparation

Sample farmers were advised to prepare a firm and compact seed bed free from stubbles and weed. One deep ploughing, followed by two or three harrowing to bring the soil to a fine tilth and application of 10 t/ha of FYM or compost besides chiselling to get additional yield was suggested and taken care to follow the same by farmers. However, due to non-availability of sufficient FYM, only a few farmers practiced the recommendations.

Plate 3: Land preparation for sowing

4.2 Workshop on soil sampling

- Workshop on soil sample testing and nutrient application was conducted
- Soil samples were drawn from the farmers in the village and was taken to KVK, Kathalgere in Davanagere where lab analysis was done.
- The soil scientists discussed with the farmers regarding the condition of the soil in the region and asked them to apply supplementary fertilizers to maintain soil balance which was deficit in their farm.
- Scientists discussed about soil health issues with the farmers. Further, corrective measures and amendments were recommended to farmers which was adopted by them.

Plate 4: Soil samples of 25 MBS farmers for analysis

Nutrient management

Maize crop responds to organic manure application and hence integrated nutrient management (INM) is an important nutrient management strategy in maize-based production systems. Therefore, for higher economic yield of maize, based on soil test results the farmers were advised to apply 10 tonnes of FYM per hectare, 10-15 days prior to sowing supplemented with 150-180 kg N, 70-80 kg Phosphorous (P_2O_5), 70-80 kg Potash (K_2O) and 25 kg Zinc Sulphate ($ZnSO_4$) per hectare was recommended. Full doses of P, K and Zn was suggested as basal application preferably drilling of fertilizers in bands along the seed using seed-cum-fertilizer drill. Nitrogen was recommended in 5-splits for higher productivity and use efficiency.

Plate 5: Mixing of microbial consortia with FYM for field application

Seed Brand

Since maize is cultivated as a commercial crop in the study area, farmers used branded hybrid maize (Table 7)

Table 7: Brands of seed used by the maize growers (n=25)

Sl. No.	Brand	Percentage
1.	CP – 818	45
2.	Proline	5
3.	Aditya	10
4.	Dhanya	40
Total		100

Farmers adopted the seed rate of 8-10 kg/ac of hybrid seeds

Sowing

Farmers were advised to plant only pre-treated hybrid seeds against any fungal outbreak (Azospirillum) produced by seed companies of national and international repute. Sowing was done in the month of July by MBS farmers.

Plate 6: Sowing of maize by farmers

Spacing

Advised a spacing of 45 cm between rows and 20 cm between plants in the row to maintain plant population of 10 – 11 plants/m^2

Plate 7: View of maize crop in field

4.3 Distribution of Maize Business School Booklet

"Maize Business School Booklet" – a farmers' manual was distributed to farmers, which contained information regarding good cultivation practices in maize, pest and disease management and daily operational log space for recording activities performed along with quantification.

Plate 8: Distribution of manual on "Maize Business School"

4.4 Farm field record keeping training

The farmers were trained regarding record keeping of every activity practiced and expenses incurred in production of maize.

Plate 9: Farmer entering in record book maintained by farmers

4.5 Distribution of Microbial consortium to farmers

- Each MBS farmer was supplied with ten packets of microbial consortium for managing maize crop against diseases and to maintain the soil health.
- Demonstration regarding the method of application of microbial consortium in the farmers field was provided.

Plate 10: Demonstration and distribution of microbial consortium

Workshop on Fall Army Worm and pest control

- Reputed entomologist from university was invited to check the extent of crop damage due to fall army worm and suggested remedial measures for their control**.**
- Suggestion was given to the farmers regarding identification control of fall army worm

Identification of FAW in field during different stages of life cycle stages

- Eggs - Spherical in shape and creamy white in colour laid singly
- Larva - Shows colour variation from greenish to brown with vertical dark brown grey lines on the body and white lines
- Pupa - Brown in colour, occurs in soil, leaf, pod and crop debris
- Adult - Light pale brownish yellow stout moth forewings are olive green to pale brown with a dark brown circular spot in the centre. Hind wings are pale smoky white with a broad blackish outer margin.

Management suggested

- Set up of light traps
- Set up 12 sex pheromone traps per hectare

Application of any one of the following on 3rd and 18th day after panicle emergence was suggested:

- Carbaryl 10 D 25 kg/ha
- Malathion 5 D 25 kg/ha
- Phosalone 4 D 25 kg/ha

Plate 11: Damage caused by FAW

Plate 12: Entomologists visit to Farmers Field

4.7 Farmers meeting and demonstration of insect traps and lure

FAW traps and lures were distributed to farmers and demonstration was conducted in the farmer's field.

Plate 13: Demonstration on use of insect traps & lure

4.8 Workshop on Control of Itchgrass (*Rottboellia cochinchinensis*) weed

Mr. Abhishekh, Assistant Technical Manager (ATM), Department of Agriculture, gave complete management practices regarding control of itch grass (*Rottboellia cochinchinensis*) weed to farmers**.**

Plate 14: Itch grass weed bordering maize plot

Itch grass control measures suggested by subject matter specialist

Successful management of itch grass depends on the depletion of its soil seed bank and preventing further production of seed. No single control tactic is able to achieve this goal, thus a truly integrated strategy is required to decrease itch grass population steadily. Available and promising tactics include mechanical, cultural and chemical controls.

Mechanical control

Shallow tillage in the beginning of the crop season can be used to promote itch grass germination prior to planting maize seeds. Emerging seedlings could then be controlled by additional mechanical means or with herbicides.

Cultural control

Since itch grass is easily dispersed with crop seed, an important tool for preventing its introduction to new fields and spread is by removing weeds prior to seed selling. Crop rotation could help in disrupting the close association between itch grass and some crops (such as maize and sugar cane) by allowing the crop rotation with pulses.

Chemical control

Selective itch grass chemical control has been achieved with some triazines (e.g., dimetamethrin), dinitroanilines (e.g., pendimethalin) and acid amides (e. g. diphenamid). Pendimethalin has proved very effective against itch grass and can be easily included as a tactic for the integrated management of this weed in maize. Application of pendimethalin (1.5 kg ha^{-1}) and inter-row cultivation at 14 and at 28 days after planting effectively controls itch grass in maize.

4.9 Farmers' exposure visit under MBS

• Farmers' exposure visit was organized to Krishimela-2019, where farmers were given information regarding production and management practices of maize crop.

• Farmers were provided opportunities to interact with seed companies, where information regarding high yielding varieties was given.

• Training was given to farmers regarding integrated farming system and poultry farming.

• Dr. Mallikarjun, maize pathologist gave information on management of ear rot in maize.

• Consultancy service was given to farmers regarding management practices of maize and Marketing of maize.

• These farmers were very enthusiastic to rear local poultry fowl. They were made to visit poultry exhibition stall and interact with experts.

Plate 15: Farmers' interaction with seed company officials regarding high yielding varieties

Plate 16: Training on poultry and integrated farming system

4.10 Training Programme on "value addition in maize"

Training program on “value addition in maize" and demonstration was conducted by Mr. Diwakar who is specialist in maize value addition from VC farm, Mandya. He gave training to villagers on preparation of different food products made out of maize like maize semolina, maize *papad*, maize flour etc, and demonstration was given on maize food preparation for items like *bisibelebath*, maize *keasribath*, maize *bajji* and maize *papad* to farmers.

Plate 17: Demonstration programme on value addition in maize

4.11 Market linkage programme

Agricultural marketing expert Dr. M. S. Ganapathy gave an overview of maize marketing and Mr. Sachin from Roots Goods company Ltd., explained the importance of effective marketing of maize through block-chain technology and assured farmers that his firm would partner with farmers and help them in marketing their produce. In this regard, the farmers were informed that the produce need to be dried properly and then inform the firm to lift the produce when ready.

Plate 18: Meetings on marketing of maize

Discussion was made with Mr. Anis, market inter-mediator in maize regarding procurement and marketing of maize to different processing industries. Dr. Chidanada, specialist in Poultry and Animal Husbandry briefed about the utilization and importance of maize by-product as fodder for cattle and also gave information on preparation of silage out of maize stalks.

Plate 19: Program on value addition and marketing of maize

4.12 Harvest and Marketing of Maize

Maize was harvested in the month of February 2020 and arrangements were made to market the produce through Block-Chain technology in collaboration with Roots Goods Company Ltd. However, due to outbreak of pandemic novel Corona Virus Disease 2019 overlapped marketing season and lockdown imposed by the government affected long distance marketing as planned earlier. Further, local traders were contacted and marketing of maize was done by the end of July where measures were taken that sample farmers would get average price of Rs 1704/ qtl which ensures that farmers get reasonable price to their produce.

Plate 20: Storage of harvested maize cobs

4.13 Monthly farmers meeting and field visit

Monthly meeting and field visit were conducted to check the progress of MBS functioning and to advice farmers regarding timely management practices that should be followed in maize production.

Plate 21: Field visits and interaction with farmers

4.14 Farmers WhatsApp group

Through WhatsApp group named “Maize Business School “comprising of all the 25 sample farmers each and every step was monitored along will updates regarding maize farming and interacted timely.

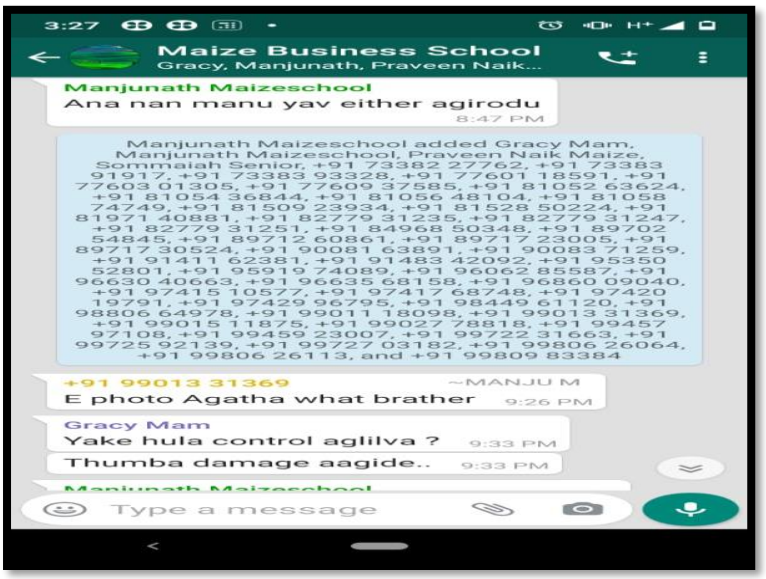

Plate 22: Snapshot of WhatsApp group comprising of sample farmers

4.15 Distribution of saplings to sample farmers

Seedlings of fruit crops such as mango, guava, jack fruit, jamoon and green manure plants were distributed to sample farmers for planting along the bunds/ fields.

Plate 23: Distribution of saplings to farmers

5. RESULTS

5.1 Critical stages in maize production and management

Critical stages of maize growth phases and management practices advised to be followed by sample farmers is provided in Table 8. Cent per cent of the farmers practiced the management practices advised by the subject matter specialist to manage critical stages identified in maize production. Full doses of P, K and Zn was applied as basal dose in bands along the seed using seed-cum-fertilizer drills. Nitrogen was applied in 5-splits as detailed below for higher productivity and use efficiency. N application at grain filling stage results in better higher yield. Therefore, nitrogen need to be applied in splits the five critical stages viz, sowing, young seedlings stage, knee high stage (V8), flowering (VT) and grain filling (GF) are the most sensitive stages for water stress.

Table 8: Critical stages identified in maize and management practices followed by sample farmers

(n=25)

Sl. No.	Stage	Days after planting	Recommended management practices	Followed/ Practiced
1.	Basal (at sowing)	0-8	20% of N	✓
2.	V4 (four leaf stage)	8-20	25% of N	✓
3.	V8 (eight leaf stage)	32-38	30% of N	✓
4.	VT (tasselling stage)	56	20% of N	✓
5.	R2-R3 (Potential kernel rows is determined)	42-46	Protective irrigation	✓
6.	R4 (Actual kernel number and potential kernel size determined)	69-75	FAW / Root worm beetle control	✓
7.	R3- R4 (grain filling stage)	90-105	5% of N	✓

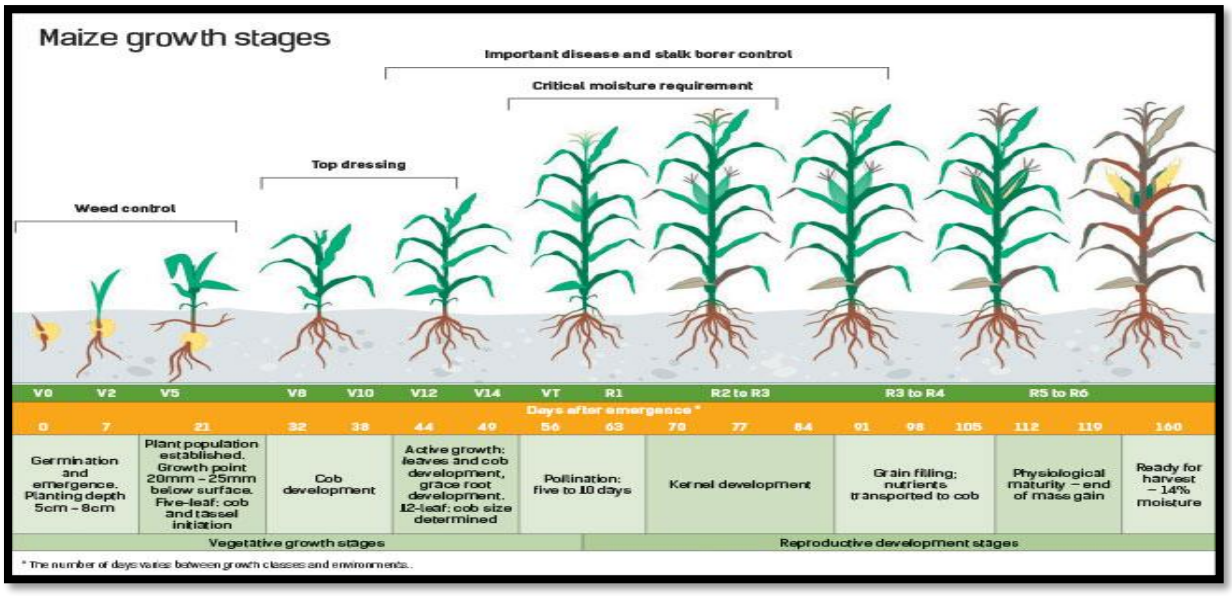

Plate 24: Different growth stages of maize

5.2 Production constraints faced by Sample farmers

Major problems faced by farmers in production of maize are shown in Table 9. Out of 25 sample farmers, 60 per cent of the farmers expressed that inadequate rainfall was a major problem, 44 per cent indicated that FAW pest was the major problem, 24 per cent of sample farmers said itch grass and wild boar was the major problems in cultivation of maize. Other problems faced by farmers are germination failure, leaf blight and no proper grain filling.

Table 9: Major problems faced by the farmers in the study area

Sl. No.	Farmers name	Inadequate rain	Pest (FAW)	Germination failure	Weed (Itch Grass)	Wild animals (Boar, bear)	Leaf Blight	No proper grain filling
1	Manjappa	✓	✓					
2	Thimmananaik	✓				✓		
3	Ramesh	✓				✓		
4	Sevanaik	✓		✓		✓		
5	Shivmurthynaik		✓		✓			
6	Kalanaik	✓						✓
7	Annappa	✓						
8	Nagarajappa	✓	✓			✓		
9	Ravi naik							
10	Bhimnaik	✓						
11	Laxmanappa	✓	✓					
12	Haleshnaik	✓	✓			✓		
13	Venkateshnaik		✓		✓			
14	Kumarnaik		✓		✓			
15	Hiranaik	✓			✓			
16	Kumarnaik							
17	Prakashnaik		✓	✓				
18	Omkarnaik							✓
19	BK Naik	✓			✓			
20	Jaya Naik					✓		
21	ManjunathNaik	✓	✓					
22	Srikanth							
23	Govindnaik		✓		✓			
24	Shankar Naik	✓						
25	Parameshnaik		✓				✓	

5.3 Yield benchmarking of individual farmer before MBS implementation

The benchmarking of farmers in the study area prior to implementation of the project based on previous year's yield method was adopted (Table 10). Bulk line method of benchmarking was followed where top two and bottom two sample observations were eliminated and average yield was obtained (i.e.,16.87qtl/acre). The difference between the actual yield and bulk line yield gives the difference in the yield level of individual farms. The farms were classified in to strong and weak categories based on the extent of shortfall in yield.

Table 10: Benchmarking report of individual farmer before MBS implementation

Sl. No.	Name of Farmer	Rainfed area(acre)	Irrigated area (acre)	Total area (acre)	Total area under Maize (acre)	Quantity sold (qtl)	Yield (qtl/ Acre)	Difference between actual and bulk line yield
1.	Manjappa	5.5	0	5.5	4.0	60	15.0	-1.87
2.	Thimmananaik	5.0	0	5.0	3.0	30	20.0	3.13
3.	Ramesh	4.5	2	6.5	4.0	35	5.0	**-11.87 (outlier)**
4.	Sevanaik	5.0	0	5.0	3.5	18	7.2	**-9.67 (outlier)**
5.	Shivmurthynaik	3.5	4.0	7.5	4.0	100	25.0	8.13
6.	Kalanaik	5.0	1.0	6.0	3.0	50	10.0	-6.87
7.	Annappa	4.0	0	4.0	2.5	65	16.25	-0.62
8.	Nagarajappa	4.5	1.5	6.0	3.5	67	22.33	5.46
9.	Ravi naik	6.5	1.5	8.0	3.0	25.0	25.0	8.13
10.	Bhimnaik	3.5	1.5	5.0	3.5	30.0	20.0	3.13
11.	Laxmanappa	3.5	1.5	5.0	3.5	30.0	30.0	**13.13 (outlier)**
12.	Haleshnaik	3.5	1.5	5.0	4.0	18.0	18.0	1.13
13.	Venkateshnaik	4.0	0	4.0	3.0	35.0	17.5	0.63

14.	Kumarnaik	3.5	0	3.5	2.5	17.5	17.5	0.63
15.	Hiranaik	3.5	1.0	4.5	2.0	36.0	18.0	1.13
16.	Kumarnaik	3.0	1.0	4.0	2.5	18.0	18.0	1.13
17.	Prakashnaik	3.0	1.0	4.0	3.0	18.0	18.0	1.13
18.	Omkarnaik	5.0	0	5.0	3.0	36.0	18.0	1.13
19.	BK Naik	3.0	2.0	5.0	4.0	30.0	30.0	**13.13 (outlier)**
20.	Jaya Naik	7.0	2.0	9.0	5.0	24.0	24.0	7.13
21.	ManjunathNaik	5.5	0	5.5	2.5	14.0	14.0	-2.87
22.	Srikanth	8.75	0	8.75	3.25	24.3	24.3	7.43
23.	Govindnaik	6.5	0	6.5	3.0	18.0	18.0	1.13
24.	Shankar Naik	6.5	0	6.5	3.0	20.7	20.7	3.83
25.	Parameshnaik	8.0	4.0	12.0	3.0	18.0	18.0	1.13

Yield performance status before MBS implementation:

Out of 25 farmers in the study area, 2 farmers (8 %) had the yield less than ten quintal per acre (very weak), 2 farmers (8 %) had yield range between ten to fifteen quintal per acre (weak), 11 farmers (44 %) had a yield range of fifteen to twenty quintal per acre(average) and 10 farmers (40 per cent) had a yield range of more than 20 quintal per acre (strong).

Table 11: Yield performance status before MBS implementation

Yield performance Status	Yield range (q/acre)	Number of farmers	Percentage to total number (%)
Very Weak	<10	2	8
Weak	10-15	2	8
Average	15-20	11	44
Strong	>20	10	40
Total		**25**	**100**

Yield performance of individual farmer after MBS implementation

Table 12shows the benchmarking of farmers in the study area for the year 2019 based on yield method. Bulk line method of benchmarking was followed where average yield was obtained (i.e., 19.76qtl/Acre). The difference between the actual yield and bulk line yield gives the difference in the yield level of individual farms. It shows that average yield has jumped from benchmark level of 16.87 q/acre to 19.76 qtl/acre resulting in 2.89 qtl increase per acre.

Table 12: Benchmarking report of individual farmer after MBS implementation

Sl.No.	Farmers name	Rain-fed in acre	Irrigated area in acre	Total in acre	Total Cropped area under Maize in acre	Quantity sold (qtl)	Output per acre (qtl)	Difference between actual and bulk line yield
1.	Manjappa	5.5	0	5.5	4.0	74	19.00	-0.76
2.	Thimmananaik	5.0	0	5.0	3.0	57	19.50	-0.26
3.	Ramesh	4.5	2.0	6.5	4.5	84	19.00	-0.76
4.	Sevanaik	5.0	0	5.0	4.0	74	19.00	-0.76
5.	Shivmurthynaik	3.5	4.0	7.5	5.0	97	19.75	-0.01
6.	Kalanaik	5.0	1.0	6.0	3.0	55	19.00	-0.76
7.	Annappa	4.0	0	4.0	2.5	45	18.75	-1.01
8.	Nagarajappa	4.5	1.5	6.0	4.0	74	18.75	-1.01
9.	Ravi naik	6.5	1.5	8.0	3.0	55	19.00	-0.76
10.	Gouramma/ Bhimnaik	3.5	1.5	5.0	4.0	75	19.00	-0.76
11.	Laxmanappa	3.5	1.5	5.0	4.0	75	19.00	-0.76
12.	Haleshnaik	3.5	1.5	5.0	4.0	77	19.75	-0.01
13.	Venkateshnaik	4.0	0	4.0	3.0	58	20.00	0.24

14.	Kumarnaik	3.5	0	3.5	2.5	51	21.00	1.24
15.	Shivakumar/Hiranaik	3.5	1.0	4.5	2.0	37	19.50	-0.26
16.	Kumarnaik	3.0	1.0	4.0	2.5	48	20.00	0.24
17.	Prakashnaik	3.0	1.0	4.0	3.0	58	20.00	0.24
18.	Omkarnaik	5.0	0	5.0	4.0	74	19.00	-0.76
19.	BK Naik	3.0	2.0	5.0	5.0	95	20.00	0.24
20.	Jaya Naik	7.0	2.0	9.0	5.0	100	22.00	2.24
21.	ManjunathNaik	5.5	0	5.5	2.5	50	21.00	1.24
22.	Srikanth	8.75	0	8.75	3.25	65	21.50	1.74
23.	Govindnaik	6.5	0	6.5	4.0	85	22.00	2.24
24.	Shankar Naik	6.5	0	6.5	4.0	85	19.50	-0.26
25.	Parameshnaik	8.0	4.0	12.0	4.0	86	19.00	-0.76

Yield performance status after MBS implementation:

Out of 25 farmers in the study area, 20 farmers (80 %) had the yield range between 15 to 20 quintals per acre and 5 farmers had the yield range of more than 20 quintals. This shows that after MBS the productivity of maize has enhanced among all sample households.

Table 13: Income performance status after MBS implementation

Sl. No.	Yield Range (qtl / acre)	Number of farmers	Percentage
1.	<10	0	0
2.	10-15	0	0
3.	15-20	20	80
4.	>20	5	20
Total		**25**	**100**

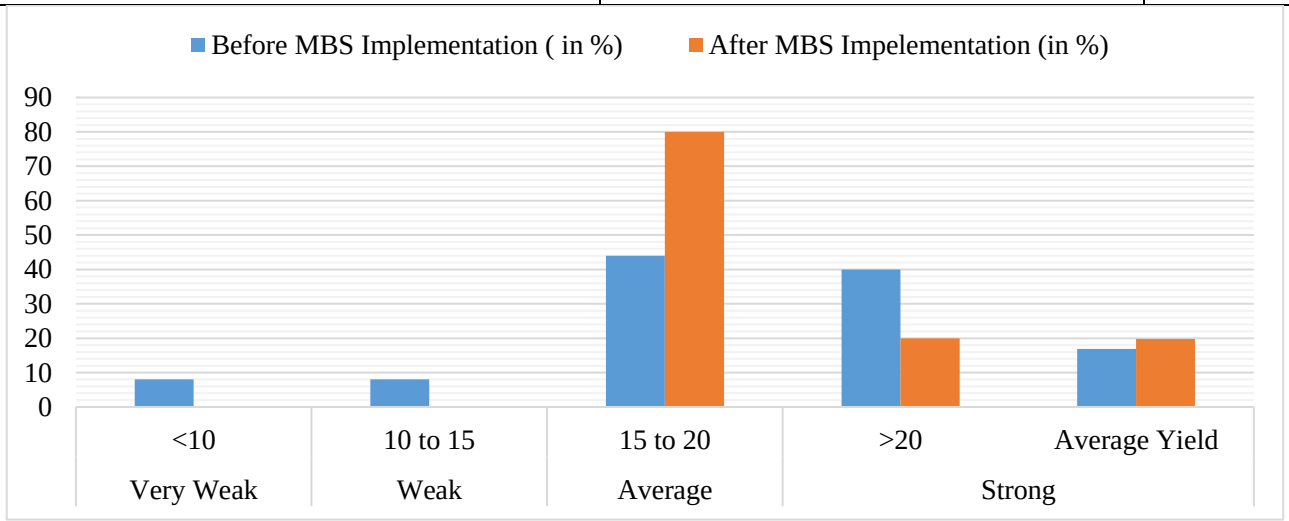

Fig 2: Yield performance status of the farmers

Income benchmarking of individual farmer before implementation of MBS

Bulk line method of benchmarking was followed where top two and bottom two income was eliminated and average income was obtained (i.e., 25,760 ₹ /acre). The difference between the actual income and bulk line income gives the difference in the income level of individual farms (Table 14).

Table 14: Income benchmarking of individual farmer for the period 2016 - 2018

Sl. No.	Farmers name	Total area under Maize (Acre)	Gross income (₹)				Average income of 3 years (₹)	Gross Income per acre (₹)	Difference between actual and bulk line income (₹)
			2018	2017	2016	Past three years total income (₹)			
1.	Manjappa	4.0	122400	96000	105000	**323400**	107800	26950	1,190
2.	Thimmananaik	3.0	60000	58500	55100	**173600**	57867	19289	-6,471
3.	Ramesh	4.0	192000	126000	140000	**458000**	152667	33926	**8,166 (outlier)**
4.	Sevanaik	3.5	96000	100000	105000	**301000**	100333	25083	-677
5.	Shivmurthynaik	4.0	185000	117600	135000	**437600**	145867	29173	3,413
6.	Kalanaik	3.0	90000	49500	77000	**216500**	72167	24056	-1,704
7.	Annappa	2.5	87500	58800	78000	**224300**	74767	29907	4,147
8.	Nagarajappa	3.5	155200	108800	121500	**385500**	128500	32125	6,365
9.	Ravi naik	3.0	43000	52000	65000	**160000**	53333	17778	**-7,982 (outlier)**
10.	Bhimnaik	3.5	59500	80000	98000	**237500**	79167	19792	-5,968
11.	Laxmanappa	3.5	105000	85800	91000	**281800**	93933	23483	-2,277

12.	Haleshnaik	4.0	104400	54000	78000	**236400**	78800	19700	**-6,060 (outlier**)
13.	Venkateshnaik	3.0	90000	44100	54600	**188700**	62900	20967	-4,793
14.	Kumarnaik	2.5	82800	57600	57600	**198000**	66000	26400	640
15.	Hiranaik	2.0	59200	42000	54000	**155200**	51733	25867	107
16.	Kumarnaik	2.5	90000	52000	56000	**198000**	66000	26400	640
17.	Prakashnaik	3.0	94500	68600	63000	**226100**	75367	25122	-638
18.	Omkarnaik	3.0	136800	104000	104000	**344800**	114933	28733	2,973
19.	BK Naik	4.0	122200	125000	135000	**382200**	127400	25480	-280
20.	Jaya Naik	5.0	137200	144000	162000	**443200**	147733	29547	3,787
21.	ManjunathNaik	2.5	80000	52000	36750	**168750**	56250	22500	-3,260
22.	Srikanth	3.25	101750	72000	63000	**236750**	78917	24282	-1,478
23.	Govindnaik	3.0	148750	86400	88000	**323150**	107717	26929	1,169
24.	Shankar Naik	3.0	153000	90000	88000	**331000**	110333	27583	1,823
25.	Parameshnaik	3.0	175000	120000	100000	**395000**	131667	32917	**7,157(outlier)**

Income benchmarking status based on Triennium average (2016-18)

Income performance was assessed by considering the average income for the period 2016-18. Out of 25 farmers in the study area, 4 farmers (16 %) had earned less than twenty thousand rupees per acre (weak), 5 farmers (20 %) had an income range of twenty thousand to twenty-five thousand rupees per acre (Average) and 16 farmers (64 %) had earned more than twenty-five thousand per acre (strong).

Table 15: Income performance status for the period 2016 -18

Income performance status	Average income range (₹/acre)	Number of farmers	Percentage to total number (%)
Weak	<20,000	4	16
Average	20,000-25000	5	20
Strong	>25,000	16	64
Total		**25**	**100**

Income performance of individual farmer after MBS implementation

The performance report of individual farmers in the study area for the year 2019 is provided in Table 16. Bulk line method of compiling avearges was followed where average income earned was ₹ 32,870/acre. The difference between the actual income and bulk line income gives the difference in the income level of individual farms.

Table 16: Income performance of individual farmer after MBS implementation

Sl.No.	Farmers name	Total Cropped area under Maize (acre)	Output (qtl/ acre)	Price (₹/ qtl)	Quantity sold (qtl)	Gross Income in ₹ (2019)	Gross Income per acre in ₹(2019)	Difference between actual and bulk line income
1.	Manjappa	4.0	19.0	1680	74	**124320**	**31080**	-1,790
2.	Thimmananaik	3.0	19.5	1660	57	**94620**	**31540**	-1,330
3.	Ramesh	4.5	19.0	1680	84	**141120**	**31360**	-1,510
4.	Sevanaik	4.0	19.0	1680	74	**124320**	**31080**	-1,790
5.	Shivmurthynaik	5.0	19.75	1700	97	**164900**	**32980**	110
6.	Kalanaik	3.0	19.0	1720	55	**94600**	**31533**	-1,337
7.	Annappa	2.5	18.75	1750	45	**78750**	**31500**	-1,370
8.	Nagarajappa	4.0	18.75	1680	74	**124320.0**	**31080**	-1,790
9.	Ravi naik	3.0	19.0	1720	55	**94600**	**31533**	-1,337
10.	Bhimnaik	4.0	19.0	1700	75	**127500**	**31875**	-995

11.	Laxmanappa	4.0	19.0	1750	75	**131250**	**32813**	-57
12.	Haleshnaik	4.0	19.75	1760	77	**135520**	**33880**	1,010
13.	Venkateshnaik	3.0	20.0	1750	58	**101500**	**33833**	963
14.	Kumarnaik	2.5	21.0	1720	51	**87720**	**35088**	2,218
15.	Hiranaik	2.0	19.5	1760	37	**65120**	**32560**	-310
16.	Kumarnaik	2.5	20.0	1760	48	**84480**	**33792**	922
17.	Prakashnaik	3.0	20.0	1680	58	**97440**	**32480**	-390
18.	Omkarnaik	4.0	19.0	1680	74	**124320**	**31080**	-1,790
19.	BK Naik	5.0	20.0	1680	95	**159600**	**31920**	-950
20.	Jaya Naik	5.0	22.0	1650	100	**165000**	**33000**	130
21.	ManjunathNaik	2.5	21.0	1700	50	**85000**	**34000**	1,130
22.	Srikanth	3.25	21.5	1690	65	**109850**	**33800**	930
23.	Govindnaik	4.0	22.0	1680	85	**142800**	**35700**	2,830
24.	Shankar Naik	4.0	19.5	1700	85	**144500**	**36125**	3,255
25.	Parameshnaik	4.0	19.0	1680	86	**144480**	**36120**	3,250

Income performance status for the period 2019

All the 25 sample farms realized an income of more than 25,000/- per acre. The enhanced income is on account of both yield and price realization.

Table 17: Income performance status for the period 2019

Income performance status	Income range (₹/acre)	Number of farmers	Percentage to total number (%)
Weak	<20,000	0	0
Average	20,000-25000	0	0
Strong	>25,000	25	25
Total		**25**	**100**

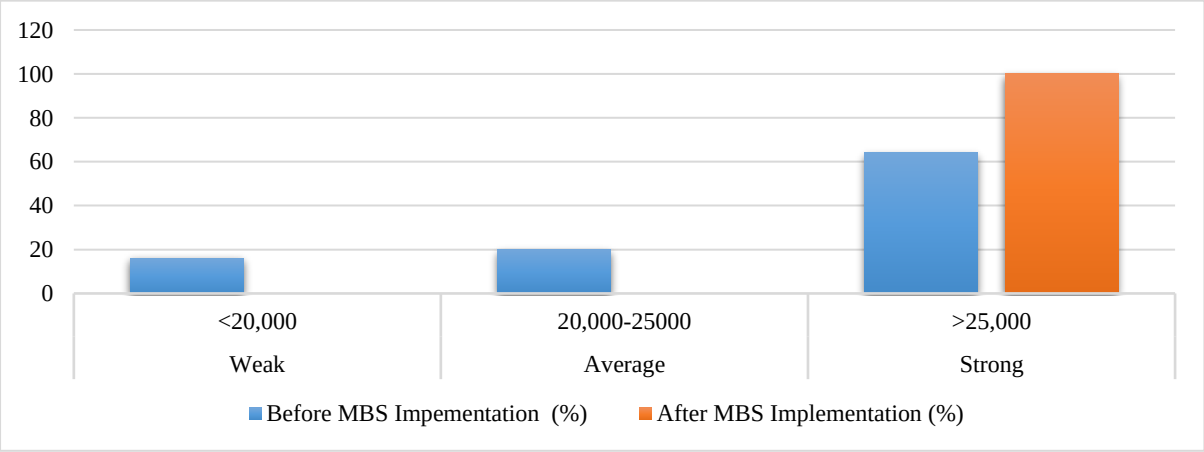

Fig 3: Income performance status of the farmers /acre

5.4 Cost of cultivation of maize before MBS implementation

The cost of cultivation was worked out by considering fixed and variable costs. and the cost of production per quintal was ₹**1450** per qtl. Out of which variable cost was 67.80 per cent towards human labour (23.31 %), machine and bullock labour (12.85 %), inputs (25.02 %), marketing expenses (0.46 %) and interest on working capital (6.48 %). The fixed cost accounted for 32.20 per cent comprising of crop insurance, land and water tax, depreciation on farm machinery and building, rental value of land and managerial cost.

Table 18: Cost of cultivation of maize for the year 2018-19					
Season: *Kharif* *Wage Rates (₹/day): Male- 287, Female- 214, Tractor (₹/hr)- 714, FYM (₹/tractor load)- 2592*					
Sl. No.	**Details**		**Quantity**	**Value (₹)**	**%**
A	**VARIABLE COST**			**18326**	**67.80**
I	**Human labour (Including family labour)**		**24.81**	**6299**	**23.31**
	Male labour(days)		13.56	3892	14.40
	Female labour(days)		11.25	2408	8.91
II	**Machine & bullock labour**		**7.42**	**3474**	**12.85**
	Tractor (hrs)		1.88	1342	4.97
	Bullock (days)		1.04	1030	3.81
	Machinery for Shelling(hrs)		2.50	980	3.63
	Sprayer (hrs)		2	122	0.45
III	**Inputs**			**6762**	**25.02**
	FYM (tractor loads)		0.69	1788	6.62
	Seeds (kg)		7.59	1503	5.56
	Fertilizer (kg)		180	2210	8.18
	Pesticides (ltr)			1260	4.66
IV	**Marketing expenses (₹)**			**125**	**0.46**
IV	**Interest on working capital (10 %) ***			**1833**	**6.78**
B	**FIXED COST**			**8702.69**	**32.20**
I	Crop insurance/Risk premium (5% of sum insured) *			0	0.00
II	Land and water tax			48	0.18
III	Depreciation on farm machinery and farm buildings			455	1.68
IV	Rental value of land (20% gross income) *			5743	21.25
V	Managerial cost (10 % of all cost) *			2457	9.09
C	**Cost**	Cost A_1 + FL		20158	**74.58**
		TOTAL COST (C_3)		**27029**	**100.00**
D	**Output**	Grain (qtl)	16.87	28713	
		Price (per qtl)		1702	
		By-product (tractor load)	1.22	2562	
		Price (per tractor load)		2100	
E	**Return**	Gross		28713	
		Over Cost A_1 + FL		8555	
		Over total cost		1684	
F	**Cost of Production (₹/qtl)**	**Cost A_1 + FL**	**1043**		
		Cost C_3	**1450**		

Cost of cultivation of maize after MBS implementation: 2019-20

The cost of cultivation was computed after the initiation of MBS. The cost of production per quintal was ₹ 1292/-, of which variable cost was 65.49 per cent comprising of human labour (24.40 %), machine and bullock labour (11.74 %), inputs (23.07 %), marketing expenses (0.44 %) and interest on working capital (6.55 %). The fixed cost accounted for 34.51 per cent (crop insurance premium, land and water tax, depreciation on farm machinery and building, rental value of land and managerial cost).

Examination of Tables 18 and 19 reveals that the cost of production per quintal has decreased substantially after MBS (₹ 1292/-) as compared to before (₹ 1450/-) due to the intervention of the project. The respective cost of cultivation per acre (Cost C3) were₹ 27029 and ₹ 28477/-. This shows that although there is a marginal reduction in cost of cultivation, the major reason for decrease in per quintal cost of production is due to increase in yield.

Table 19: Cost of cultivation of maize for the year 2019-20					
Season: ***Kharif*** *Wage Rates (Rs./Days): Male- 343, Female- 232, Tractor (Rs./hrs)- 714, FYM (Rs./Tractor Load)-2592*					
Sl. No.	**Details**		**Unit**	**Cost/Return**	**%**
A	**VARIABLE COST**			**18651**	**65.49**
I	**Human labour**		**24.1**	**6948**	**24.40**
	Male labour		12.22	4191	**14.72**
	Female labour		11.88	2756	**9.68**
II	**Machine & bullock labour**		**7.50**	**3342**	**11.74**
	Tractor (hrs)		1.72	1252	**4.40**
	Bullock (days)		1.08	918	**3.22**
	Machinery (hrs) (Shelling)		2.70	1050	**3.69**
	Sprayer		2	122	**0.43**
III	**Inputs**			**6570**	**23.07**
	FYM (tractor loads)		0.95	2462	**8.65**
	Seeds (kgs)		6.52	1317	**4.62**
	Fertilizer (kgs)		180	2210	**7.76**
	Pesticides (ltr)			580	**2.04**
IV	**Marketing expenses (₹)**			**125**	**0.44**
IV	**Interest on working capital (10 %) ***			**1865**	**6.55**
B	**FIXED COST**			**9825.99**	**34.51**
I	Crop insurance/Risk premium (5% of sum insured) *			0	**0.00**
II	Land and water tax			48	**0.17**
III	Depreciation on farm machinery and farm buildings			455	**1.60**
IV	Rental value of land (20% gross income) *			6734	**23.65**
V	Managerial cost (10 % of all cost) *			2589	**9.09**
C	**Cost**	Cost A_1 + FL		20516	**72.04**
		TOTAL COST (C_3)		**28477**	**100.00**
D	**Output**	Grain (qtl)	19.76	33671	
		Price (Per qtl)		1704	
		By-product (tractor load)	1.47	2937	
		Price (per tractor load)		1998	
E	**Return**	Gross		28713	
		Over Cost A_1 + FL		8197	
		Over total cost		236	
F	**Cost of Production (Rs./qtl)**	**Cost A_1 + FL**	**890**		
		Cost C_3	**1292**		

6. Impact of MBS Participation

Farmers' satisfaction with MBS facilitation and implementation

In terms of farmers' satisfaction with MBS facilitation and implementation, the majority of farmers were completely satisfied with MBS facilitation and implementation. With regard to participation, respondents were asked primarily about how the facilitator conducted training sessions and delivery of the training materials to farmers. Questions regarding MBS implementation were meant to capture opinion of farmers about the MBS program in general. Seventy-nine per cent of farmers reported being completely satisfied with MBS facilitation, while 14 per cent indicated to have been somewhat satisfied, and the rest were mostly satisfied. In terms of implementation, 67 per cent indicated they were completely satisfied with MBS implementation, while 21 per cent were somewhat satisfied, and the rest were mostly satisfied.

Among farmers, who indicated they were very satisfied with MBS facilitation; the stated reasons were:

(1) The facilitator explained things very well using practical examples
(2) Farmers were able to understand what they were being taught
(3) The facilitator taught patiently and was committed and dedicated
(4) Group lessons were very good
(5) Training sessions were taught in vernacular language
(6) The trainer was approachable
(7) The training sessions were interactive

Among farmers who indicated they were very satisfied with MBS implementation; the stated reasons were:

(1) MBS helped in increasing maize yield
(2) Timely intimation and interaction through WhatsApp group was very useful
(3) MBS helped farmers to plan marketing of produce
(4) The training sessions were educational
(5) Farmers tour organized was very useful
(6) MBS as a program did not lack resources
(5) Farmers who were participating received booklet and notebooks
(7) MBS helped in increasing income from maize

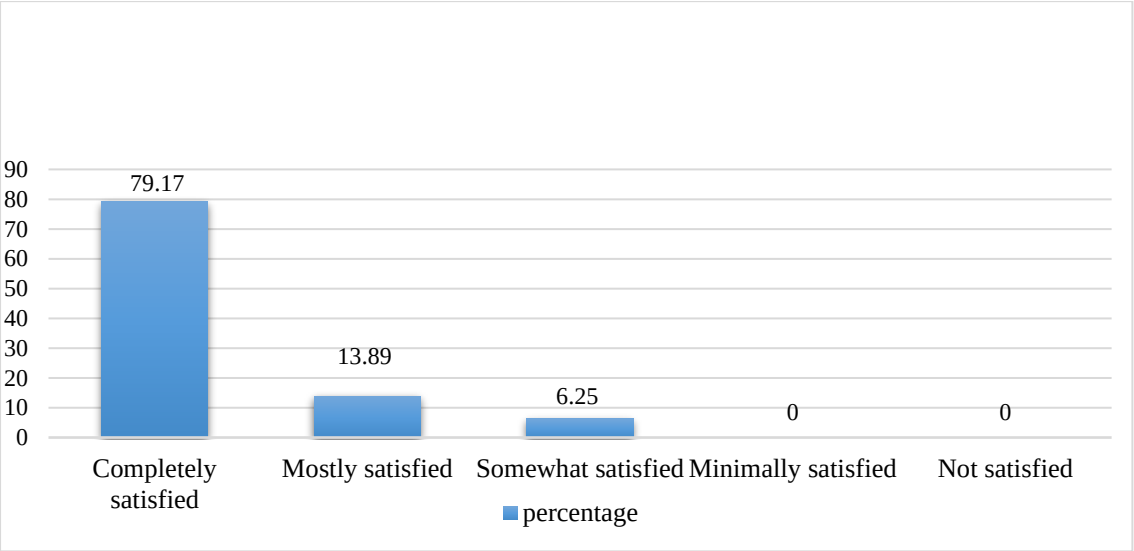

Fig 4: MBS facilitation satisfaction level

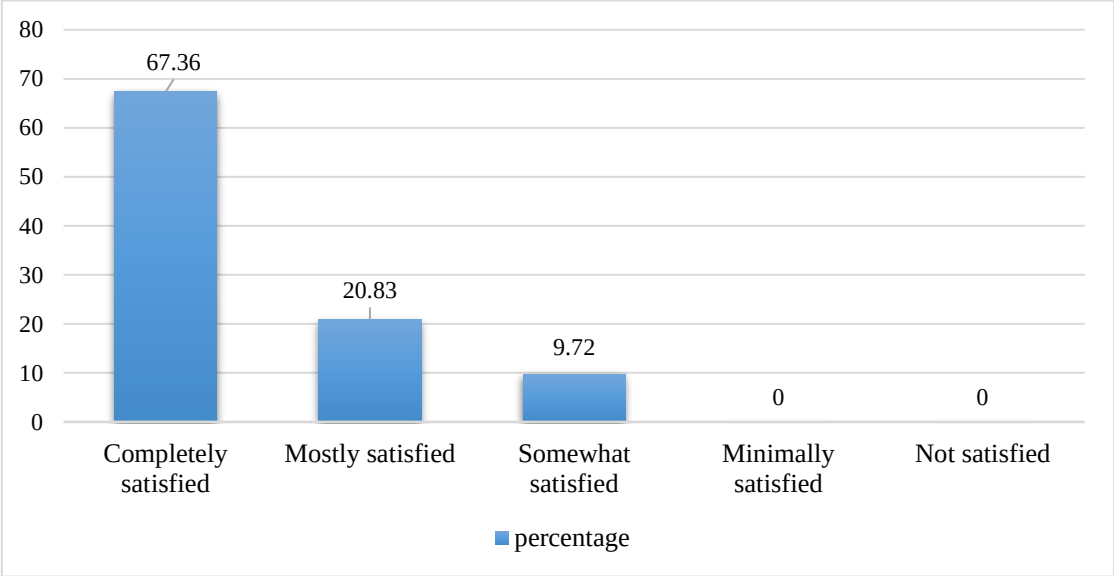

Fig 5: MBS overall satisfaction level

Topics learnt by MBS farmers

The majority of farmers indicated that they learned new concepts from the MBS training sessions. Figure 6 shows topics learned by MBS farmers. The majority of farmers (90%) reported MBS WhatsApp group was extremely useful, while 8 per cent said moderately useful and 2 per cent among the MBS farmers said WhatsApp group was useful for intimation and update the information regarding MBS. About training program on production practices in maize, 96 per cent of the MBS farmers reported that training was

extremely useful and 4 per cent felt it is moderately useful whereby they learnt about improved cultivation practices in maize. This included land preparation, fertilizer and micro nutrient application, quality seeds, seed treatment, sowing, inter-cropping in maize, conventional weed and pest control technique and proper harvest of maize. A majority of MBS farmers (95%) opined that the booklet on maize provided all management practices of maize in easy and understandable format was extremely useful and 5 per cent of farmers said moderately useful. 98 per cent of MBS farmers were of the view that maintenance of farm record suggested by specialist was extremely useful and 2 per cent opined it was moderately useful to track the expenses and management practices followed. Cent per cent of farmers said soil sampling and report of the sample was extremely useful for application of fertilizers. Regarding Microbial Consortium, 90 per cent of beneficiary farmers said it was extremely useful and it was for the first time they had exposure to such pest control measures, 5 per cent of the farmers said moderately useful and 5 per cent of the farmers reported it was useful in getting more yield compared to previous years. 87 per cent of the farmers reported that training program on control of FAW was useful, 10 per cent of farmers opined it was moderately useful and 3 per cent indicated that program was useful in control of FAW. Majority (80 %) of the farmers opined that farmers exposure visit to Krishimela-2019 was extremely useful, 10 per cent expressed that it was moderately useful and 10 per cent perceived that tour was useful. 90 per cent of the farmers affirmed training program on value addition in maize was extremely useful, 5 per cent of farmers each indicated moderately useful and was useful. 80 per cent of the farmers indicated that the program on market linkage in maize was extremely useful, 10 per cent each of farmers opined that program was moderately useful and 5 per cent of the farmers indicated it was useful.

The training sessions provided farmers with information on the best practices in time management, crop husbandry practices such as crop rotation and appropriate spacing, record keeping, searching markets for good prices, calculating profits and gross margins. Some MBS farmers also alluded to changes in people's behaviour after attending MBS. Some farmers mentioned being able to teach others about modern farming techniques.

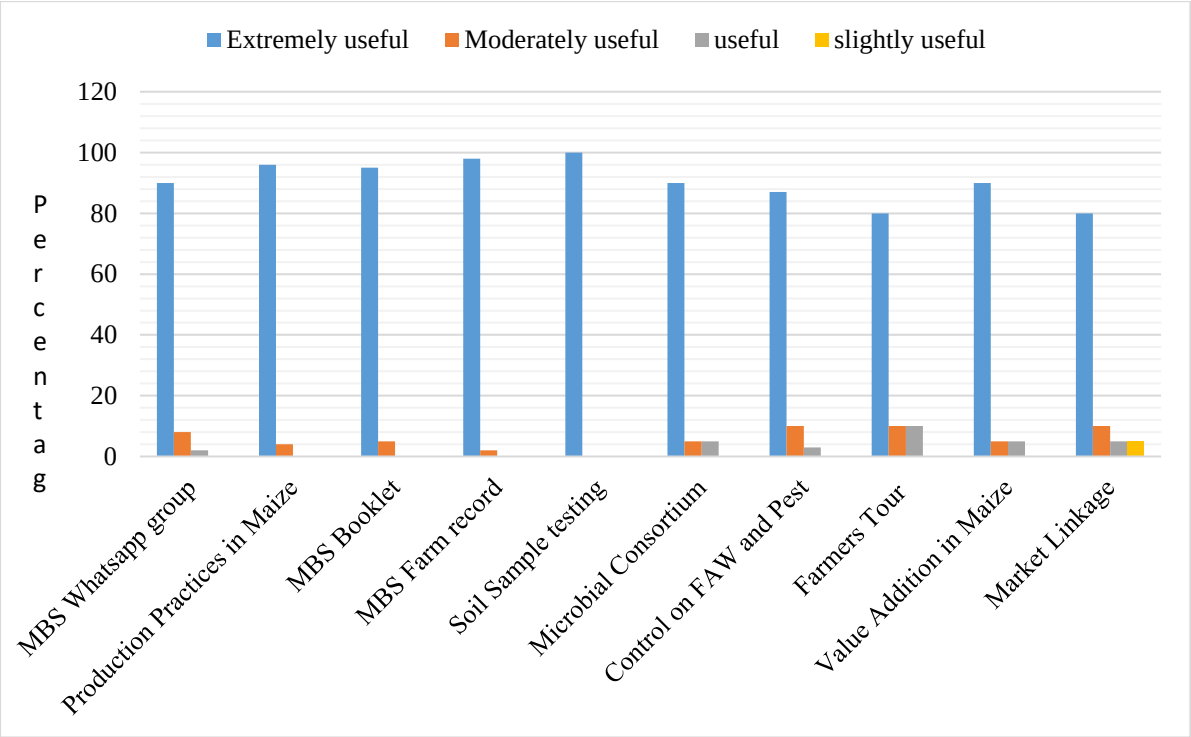

Fig 6: MBS farmers opinion on usefulness of topics learnt

7. Major findings and policy implications

- Majority (60 %) of the maize growers in the project area belonged to the age group of 31-50 years followed by age groups of above 50 years (24 %) and up to 30 years (16 %).
- With regard to education level of maize growers, 56 per cent of them had education up to primary school, followed by those with no formal education (24 %), High school (12 %), PUC (8 %), and none of the sample farmers was graduates.
- Majority (84 %) of the families of maize growers were joint in nature while the rest (16 %) had nuclear families. The average family size of the households was about seven consisting of three adult males, two adult females and two children.
- Agriculture was the main occupation among all the sample maize growers.
- The average farm size of sample farmers was 5.87 acres. About 82.62 per cent of the farm was dry land followed by irrigated land (17.37 %).
- The average area under maize cultivation of MBS farmers was 3.59 acres with average increase of 0.24 acres under maize production compared to benchmark period.
- Majority of the sample farmers used hybrid seeds for maize production. Brand distribution of maize seed shows as such, CP (45 %), Dhanya (40 %), Aditya (10 %) and Proline (5 %).
- Important critical stages identified in maize production and management practices suggested are:

Sl. No.	Stage	Days after planting	Management practices
1.	Basal (at sowing)	0-8	20 % of N
2.	V4 (four leaf stage)	8-20	25 % of N
3.	V8 (eight leaf stage)	32-38	30 % of N
4.	VT (tasselling stage)	56	20 % of N
5.	R2-R3 (Potential kernel rows is determined)	42-46	Protective irrigation
6.	R4 (Actual kernel number and potential kernel size is determined)	69-75	FAW / Root worm beetle control
7.	R3- R4 (grain filling stage)	90-105	5 % of N

- All the sample farmers adopted the management practices advised by the subject matter specialist/project team for managing critical stages in maize.
- Major problems faced by sample farmers in production of maize were, inadequate rainfall (60%), FAW Pest (44%), itch grass weed (24%) and other minor problems were wild animals attack, germination failure, leaf blight and in proper grain filling.

Changes in outcome before and after MBS

- The study examined the changes in outcome indicators, such as farm income and quantities of maize produced, cost of cultivation before and after MBS participation. In order to derive a comparable measure of change in outcome indicators among MBS farmers, the relevant data were collected from farmers for computation of cost of production of maize. Before MBS implementation the cost of production per quintal of maize was ₹ 1450 on the other hand after MBS implementation cost incurred in production of maize was ₹ 1292.
- Cent percent of MBS farmers reported experiencing positive changes in farm income from MBS participation. The average income from maize after MBS participation was ₹ 32,870 per acre i.e., Increase of ₹ 7,111 per acre for the year 2019, in comparison to past three year's average benchmark income of ₹ 25,759 per acre.
- Across all outcome indicators, majority of the MBS farmers experienced substantial changes in the yield of maize per acre. The average yield for the year 2018-19 was 16.87 qtl and after implementation the yield per acre for the year 2019-20 was 19.79 qtl, thus accounting for an average increase in yield of 2.89 qtl/acre. This is attributed to use of hybrid seeds recommended by subject matter specialist and adopting recommended management practices.

Impact Evaluation:

- Seventy-nine per cent of target farmers reported being completely satisfied with MBS facilitation while, 14 per cent indicated to have been somewhat satisfied, and the rest were mostly satisfied. In terms of implementation, 67 per cent indicated they were completely satisfied with MBS implementation while, 21 per cent were somewhat satisfied, and the rest were mostly satisfied.
- Majority of sample farmers indicated that all the training programs conducted were highly useful.

Primary outcome

The primary outcome of the project is impact on economic outcomes, including maize yields, profits (revenues minus costs), networking with farmers and officers and household utilization of maize.

Secondary outcome

Intermediate outcomes include improvement in the knowledge and capacity of farmer, adoption of new approaches (including reduced pesticides use) and adopting book keeping for tracking income and expenditure.

Policy Implications

- MBS provides learning by doing opportunity and business dimension to farming, which needs to be expanded within the community through long term piloting.
- Such commodity specific business schools have to be launched out for each district, keeping in view of the regional comparative advantage in cultivating such specific commodities.
- There is a need to combine other developmental programs with MBS for holistic growth of commodity specific business schools.
- The duration of business school project could be for a minimum of three years to ensure successful training and adoption of all relevant technology to manage critical stages of the business venture being proposed.
- Marketing and value addition are the important aspects in enhancing farmers income. Therefore, the concept of FPOs needs to be promoted for the success of farmer business schools.

Project Team

 **Dr. C.P. Gracy**	**Principal Investigator** Retired Professor and Head Department of Agricultural Marketing, Co-operation and Business Management UAS, Bangalore – 65
 **Dr. M. S. Ganapathy**	**Co-Principal Investigator** Professor and Head Department of Agricultural Marketing, Co-operation and Business Management UAS, Bangalore – 65
 **Dr. Siddayya**	**Co-Principal Investigator** Professor Department of Agricultural Marketing, Co-operation and Business Management UAS, Bangalore – 65
 **Dr. G. Ranganath**	**Co-Principal Investigator** Assistant Professor Department of Agricultural Marketing, Co-operation and Business Management UAS, Bangalore – 65
 **Dr. Satheyendra Kumar A D**	**Project Co-ordinator** Assistant Professor CCS NIAM Jaipur-302033
 **Mr. Somaiah, K. P.**	**Senior Research Fellow** Department of Agricultural Marketing, Co-operation and Business Management UAS, Bangalore – 65.
 **Mr. Raghavendra, P. K**	**Senior Research Fellow** Department of Agricultural Marketing, Co-operation and Business Management UAS, Bangalore – 65