RAJASTHAN AGRICULTURAL COMPETITIVENESS PROJECT

Value Chain Analysis

Bajra

Prepared by:

Grant Thornton
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AGRI BUSINESS PROMOTION FACILITY

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Executive Summary: Bajra

Bajra (Pearl millet-Pennisetum glaucum) is the most widely grown variety among all millets in India. It is a highly nutritious coarse cereal grain and highly suitable for cultivation in semi-arid zones. Bajra is mostly consumed as the major cereal in winter in north India. Much of the marketable surplus is used by animal feed industry and that too in winter. Its harvesting season coincides with the onset of winter in Rajasthan matching its demand in the winter season. However, because the wholemeal quickly goes rancid, bajra flour (prepared by pounding or milling) can be stored only for short periods. Recently, bajra has also found usage in Malting industry and gaining some economic importance therefore. Bajra Stover is a valuable livestock feed in many regions in India, Africa and Gulf countries. A new variety of bajra i.e. "Napier bajra" is also seen gaining ground as it is a multi-cut variety for three years after single sowing and highly suitable crop for animal fodder.

Rajasthan is the largest producer of Bajra in India, with production of 3.63 MMT (2013-14) followed by Uttar Pradesh and Gujarat. The major bajra producing districts in Rajasthan are Jodhpur, Barmer, Nagaur, Bikaner, Churu, Ganganagar, Sawai Madhopur, Alwar, Kota, Tonk, Jhunjhunu, Pali and Jaisalmer. The important bajra producing clusters under RACP are Mokhampura, Bansur, Bari, Bonli, Deoli and Ladnun. Out of these, Bajra has been selected as a value chain intervention crop in Bansur, Bari and Dooni-Deoli clusters.

It is generally grown in rainy (Kharif) season (June-September) but is also cultivated during post-rainy (Rabi) season (November-February) at a small scale in Andhra Pradesh, Maharashtra and Gujarat.

Some important support institutions for Bajra in Rajasthan are Department of Agriculture, Govt. of Rajasthan who provide extensive support through their team of State/District/ Tehsil and Panchayat level officials, recommend package and practices for the crop, provide mini kits for crop demonstration and subsidy support on certified seed distribution to farmers. Other support structures of the Department of Agriculture are the Rajasthan State Seed and Organic Production Certification Agency, The Rajasthan State Seeds Corporation Ltd, Rajasthan State Warehousing Corporation, Department of Agriculture Marketing and Rajasthan State Agriculture Marketing Board who contribute to the productivity, storage and market linkage of the crop. Apart from this, there are various Krishi Vigyan Kendras around Jaipur, Alwar and Jodhpur attached through State Agriculture Universities/ ICAR also contribute in terms of seed production, technology demonstration and post-harvest management of the crop. RARI, Durgapura has also played a significant role in production of improved varieties of Bajra contributing to both production and productivity in the State. Other support institutions in Rajasthan include the ATCs of the State Government who help in technology demonstration and scientific trial of various varieties for recommending PoP for the various agro-climatic regions for the crop.

Currently, India is the leading commercial producer of this crop, followed by China and Nigeria. Among millets, Bajra has the highest share in exports followed by Shorghum (APEDA). Yemen, Saudi Arabia and UAE are the major importers of bajra from India. Major Indian ports handling Bajra export are; ICD Kanakpura (Jaipur), ICD Tuglakabad (Delhi),

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Mundra Port, Nava Shiva (Mumbai). Exports are mainly of three varieties: Bajra grain as feed has highest requirement in Gulf countries followed by Bajra seeds for growing fodder locally. Roasted Bajra has a demand in the US (though not very significant). Bajra flour is mainly exported to Johanusburg Port. Average price of a 20 MT shipment of Bajra is around USD 9395.44/ INR 434,889/ INR 2174 per quintal FOB. Apart from the above, the export price of bajra seed grain from Mundra port is around INR 2174 per quintal FOB.

The national productivity of Bajra is 1255 kg/ha. The productivity of Bajra in Cluster districts is way ahead of state productivity of (1093 kg/ha). In case of Alwar (1799 kg/ha) and Dholpur (1943 kg/ha), it is almost double the state productivity. Bajra is also a dominant crop in Alwar and Dholpur with almost 46 to 52% cropped area under Bajra production. The productivity of bajra however varies from as low as 5 qtl per ha to 25 qtls per ha in various parts of Rajasthan due to difference in soil and rain fall conditions. The cost of cultivation for a standard Bajra farmer in eastern Rajasthan is around Rs 15350 per ha with a gross earning of Rs 25200/ha and a net earning of Rs 9850 from the sale of grains. However, Bajra dry fodder has a great economic significance for the farmers and farmers continue growing bajra even in case of low productivity due to the fodder requirements.

Key strengths of Bajra value chain are; 1. Its tolerance to drought, heat and soil salinity along with its higher water use efficiency makes it a climate-smart crop. 2. It provides feed to large number of animals and grown for silage and hay purpose also 2. It is highly suitable Kharif crop for semi-arid condition of Rajasthan.

Key weakness of Bajra value chain are; 1. Bitter taste, 2. Suitable for consumption in colder season only, 3. Bajra flour cannot be stored for a longer period.

Key opportunities for Bajra value chain are; 1. Potential for increased use as flour, cakes, snacks during winter, 2. Potential for local sorting/ grading by FPCs through FCSC, 3. Potential for use in brewing industry.

Key threats in Bajra value chain include; 1. Adverse climatic conditions and 2. Lack of good remuneration from cultivation, 3. Lower value adding opportunities as compared to other cereals

Generally in case of sale of bajra grain, farmers share in consumer rupee is 81.59% (Rs 991 profit), trader – 4.08% (Rs 70 margin), processor-8.57% (Margin Ra 147), wholesaler – 1.92% (Margin 1.92%) and 3.85% (Rs 66 margin).

In case of processed Bajra like Bajra flour and biscuits, the share of farmer would reduce almost to around 40-455 and balance margin would be re-distributed among traders and processors.

Pre Intervention Value Chain: Bajra

The pre-intervention value chain for bajra involves basically two production-distribution or activity-marketing channels, namely one related to food processors and the other related to feed processors. Presently, village traders and the mandi largely facilitate aggregation of produce. Producers suffer from want of storage and grading and sorting facilities and value accruals are limited.

Proposed post Intervention Value Chain: Bajra

The restructured value chain will have FPCs and their FCSCs replacing Mandi's and undertaking aggregation plus grading and sorting and packaging services. The FPCs will work on input facilitation, custom hiring and marketing of produce. In the post intervention value chain, a third channel may be developed by targeting value-added products of bajra and promoting their increased usage among general public through awareness campaigns. The FPCs could undertake a gamut of activities ranging from input facilitation (seeds, pesticides, fertilisers), custom hiring in addition to providing common facility storage and primary processing facilities. These could help in increasing net value accruals to farmers by 15-30%.

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Seed availability though not a major issue is largely controlled by private players like Pioneer, JK, Proagro seeds whose MRP is around INR 460/1.5 kg. There are also many local players doing third party production of bajra seeds from Hyderabad area and selling at the price of branded seeds with around 50% margin structure for the dealership network. In this context, a seed production programme may be launched availing the services of Raj seeds for few FPCs. At the post-harvest stage constraints in terms of high moisture content, storage facility, high level of dirt and impurities in the harvested crop. Well-designed FCSCs could help address these vices issues at the farm/producer level. At the processing stage, gaps are most apparent, in terms of awareness amongst processors and inadequate producer processor links etc. These may be reduced through information dissemination and B2B initiatives matched with policy incentives (like mandi tax exemption) to facilitate the same. may be addressed through inputs in start-up for related enterprises/links with large players like Cargill etc. Dissemination of benefits of direct Purchase licence and apt contract farming modes are other related interventions.

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Chapter 1- Introduction

Pearl millet/ bajra (Pennisetum glaucum) is the most widely grown variety among all millets in India. It is highly suitable for cultivation in semi-arid zones. It is a highly nutritious coarse cereal grain. Bajra ranks third after rice and wheat, and is a major source of dietary energy and nutritional security for the rural population in many parts of India. It has high levels of protein with better amino acid balance than other major cereals such as rice, wheat and maize. It also has high levels of fat content, dietary fibre, and several minerals, including iron and zinc. Studies at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad, have shown large availability of Iron and Zinc in Bajra i.e. iron content varying from 42 to 67 mg/kg and zinc content varying from 37 to 52 mg/kg in different cultivars.

Origin and Importance

Bajra originated in central tropical Africa and is widely distributed in the semi-arid tropics in India. The plant was probably domesticated as a food crop around 4000 to 5000 years ago along the southern margins of the central highlands of the Sahara. It has since become widely distributed across the semi-arid tropics of Africa and Asia. Millet is an important staple food in Africa where it is used to make a traditional flatbread known as "Injera".

In the middle Ages, millet was a staple grain in Europe, especially in Eastern Europe. It was introduced in the United States in the 19th century. Millet is popular as birdseed and livestock fodder in Western Europe and North America and has recently gained popularity as a delicious and nutritious grain due to its nutritious benefits and gluten-free status.

Currently, India is the leading commercial producer of Bajra, followed by China and Nigeria.[1]

Bajra grain is the staple diet for farm households in the world's poorest countries and among the poorest people. In the sub-saharan region of Africa and rural regions of north western India, Bajra is an important cereal for consumption. Bajra stover is a valuable livestock feed in the growing regions in India and Africa.

Further, Bajra is a high-energy, nutritious food, specially recommended for children, convalescents and the elderly. Several food preparations are made from bajra, which differ between countries and even between different parts of a country. These consist primarily of porridge or pancake-like flat bread. However, because wholemeal quickly goes rancid, millet flour (prepared by pounding or milling) can be stored only for short periods.

[1] 2016 (http://millets.res.in/m_recipes/Nutional_health_benefits.pdf) (retrieved on April 13,2017)

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Table 1: Nutritional Value Bajra (Bajra)[2]

Food grain	Bajra
Carbohydrate (g)	67.5
Protein (g)	11.6
Fat (g)	5
Energy (kcal)	361
Crude Fiber (g)	1.2
Mineral Matter (g)	2.3
Calcium (mg)	42
Phosphorous (mg)	296
Iron (mg)	42

Source: Nutritive value of Indian foods, National Institute of Nutrition (2007)

1.1. Global Scenario

Bajra is grown on more than 29 million hectares in the arid and semi-arid tropical regions of Asia (11 million hectares), Africa (16 million hectares) and Latin America.

Bajra grows quickly, meaning it can make the most of brief periods of favourable conditions. Although average yield world over are low, averaging 500 to 600 kilograms a hectare, Bajra is more reliable than maize or sorghum in semi-arid areas.

Table 2: Major Bajra Producing Countries (in Kg)

S No.	Country	Production(2012)	Production(2013)	Production(2014)
1	India	1,03,30,000.00	1,09,10,000.00	1,14,20,000.00
2	Nigeria	50,00,000.00	50,00,000.00	13,84,900.00
3	Niger	38,62,155.00	29,95,000.00	33,21,753.00
4	Mali	17,72,275.00	11,52,331.00	17,15,044.00
5	China P Rp	16,00,000.00	17,46,500.00	23,44,666.00
6	Burkina Faso	10,78,374.00	10,78,570.00	9,72,539.00
7	Chad	9,24,000.00	5,82,000.00	6,94,751.00
8	Ethiopia	7,42,297.00	8,07,056.00	9,15,315.00
9	Fmr Sudan	3,78,000.00	10,90,000.00	12,45,000.00

Source: APEDA AgriXchange

The production of Bajra has mostly been rising in top growing countries except Nigeria, Chad, Mali and Burkina Faso. A significant rise in production can be seen in China, Sudan and Ethiopia. India also has a growth trend but not significant.

[2] http://millets.res.in/m_recipes/Nutional_health_benefits.pdf (retrieved on April 13,2017)

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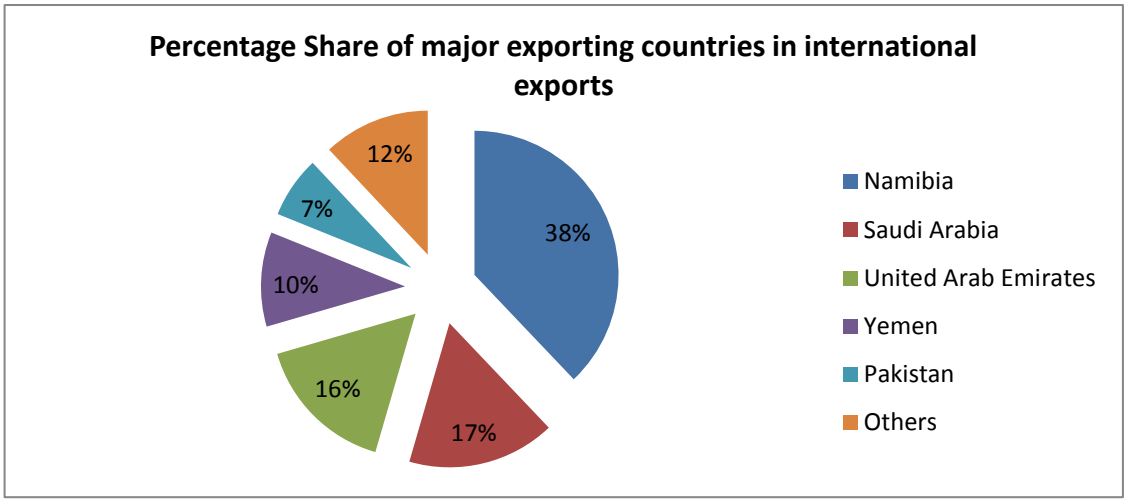
Table 3: Percentage Share of major exporting countries in international exports

Sr. No.	Country	Percentage Share (%)
1.	Namibia	37.9
2.	Saudi Arabia	16.6
3.	United Arab Emirates	16.0
4.	Yemen	10.6
5.	Pakistan	6.9
6.	Others	12

Source: APEDA AgriXchange

Figure 1: Percentage Share of major exporting countries in international exports



1.2. Indian Scenario

India is the largest producer of Bajra in Asia. In the three-year period 2008-2010 about 9 million hectares were planted, producing about 8.3 million metric tons a year. The average yield was 930 kilograms a hectare. The area used for Bajra plantation in India has fallen since the early 1980s but production has increased by 36% as yields have risen from 530 kilograms a hectare 1981-1983 to 930 kilograms a hectare 2008-2010, showing a 75% increase in productivity. Bajra accounts for 15-62% of the cereals consumed in major Bajra growing states such as Maharashtra, Gujarat and Rajasthan.[3]

In India, Bajra was the second millet crop in terms of area, production and productivity after sorghum till 2002-03 and thereafter it has occupied the first position under the category of millets. It is largely grown as a Kharif crop in Rajasthan, Maharashtra, Uttar Pradesh, Gujarat, Haryana, Karnataka, Madhya Pradesh and Tamil Nadu. It is also grown during Rabi (after rainy season) in Andhra Pradesh and summer in Gujarat and Karnataka. In recent years, summer area under Bajra in Gujarat has increased substantially. The area under Rabi season in Andhra Pradesh and under summer crop in Karnataka is negligible. Summer season Bajra is cultivated as an irrigated crop under high levels of agronomic management.[4]

Bajra has larger consumption in rural areas than urban. Although the demand for food Bajra has decreased by 14% CAGR in past 3 years but the demand in alternate segment (non-food) like cattle feed and malt is increasing and currently captures almost about 70% of the total consumption of Bajra.

[3] http://www.cgiar.org/our-strategy/crop-factsheets/millets/ (retrieved on April 14,2017)
[4] http://www.aicpmip.res.in/pcr2015.pdf (retrieved on April 13,2017)

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Table 4:National Demand Growth of Bajra (per capita consumption in kg)

(Area - Million Hectares Production - Million Tonnes Yield - Kg/Hectare)

National Demand Growth of Bajra (per capita consumption in kg)		
1999-2000	2004-2005	2009-2010
2.79	1.66	2.07

Table 5: All India area, production, yield and area under irrigation %[5]

(Area - Million Hectares Production - Million Tonnes Yield - Kg/Hectare)

Year	Area	Production	Yield	Area Under Irrigation %
2008-09	8.75	8.89	1015	9.4
2009-10	8.78	6.51	731	8.6
2010-11	9.61	10.37	1079	8.3
2011-12	8.78	10.28	1171	8.5
2012-13	7.3	8.74	1198	-

Source: Department of Economics and Statistics, Department of agriculture and cooperation.

Area coverage and production of Bajra during 2012-13 were up by 1.58 Million hectares and 1.54 million tonnes respectively compared to the corresponding period of 2011-12 but Yield of Bajra during 2012-13 was down by 33 Kg/Hectare compared to the corresponding year of 2011-12.[6]

Rajasthan is the largest producer of Bajra with production of 3.63 MMT (2013-14) followed by Uttar Pradesh and Gujarat. The state wise production of Bajra is given in the table below;

Table 6: Major Bajra producing states in India 2013-14

Sr. No.	State	Area (million hectares)	Share (%)	Production ('000 tonnes)	Share (%)
1	Rajasthan	4.43	56.77	3.63	39.21
2	Uttar Pradesh	0.92	11..77	1.87	20.19
3	Gujarat	0.69	8.89	1.21	13.07
4	Haryana	0.40	5.17	6.83	8.98
5	Maharashtra	0.76	9.76	0.79	8.52
6	Madhya Pradesh	0.19	2.42	0.38	4.10
7	Others	0.4	5.23	0.55	5.92

Source: Ministry of Agriculture

Exports:

In terms of exports of Bajra from India, major quantities are exported to Yemen, Saudi Arab and UAE.

[5] http://eands.dacnet.nic.in/PDF/Agricultural-Statistics-At-Glance2014.pdf (retrieved on April 14,2017)
[6]http://krishijagran.com/farm/scenario-in-india/2014/12/All-India-Area-production-and-yield-statuscrops-during-

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Figure 2: Percentage share of area coverage

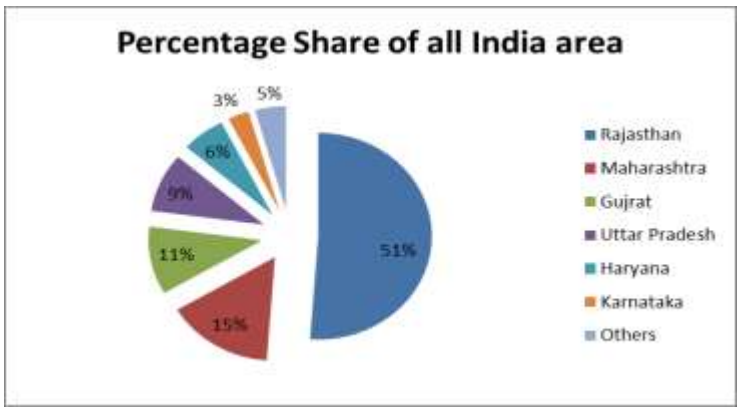
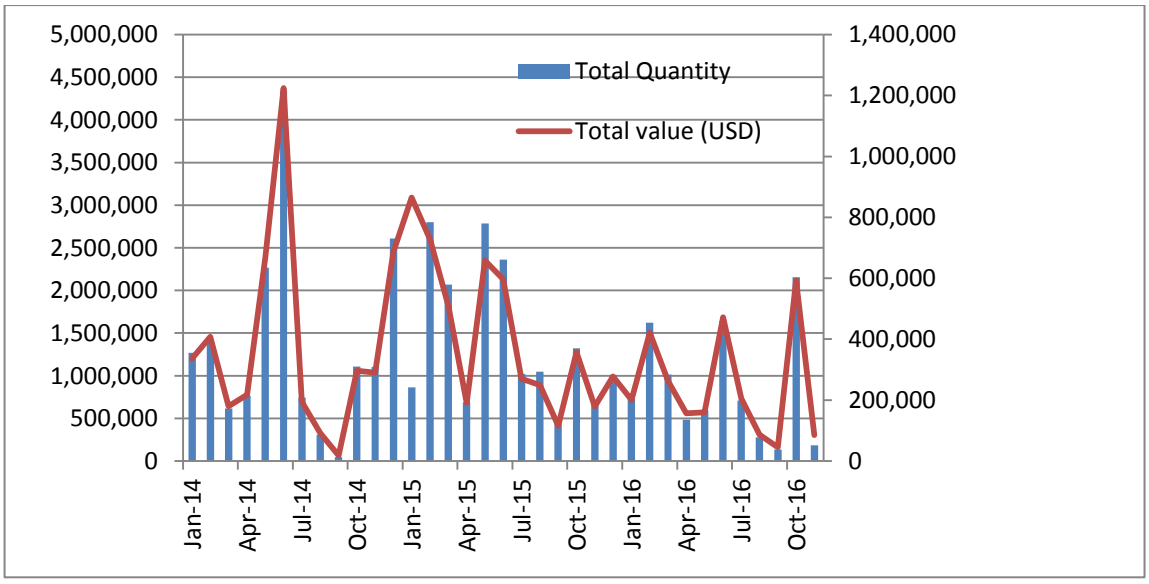


Table 7: Major exports of Bajra from India (2012-13)

S No.	Country	Quantity (Kg)	Value (Rs)
1	Yemen Republic	2,03,25,207.00	30,93,92,320.00
2	Saudi Arab	78,38,000.00	12,13,53,644.00
3	U Arab Emts	79,43,990.00	11,98,02,526.00
4	Vietnam Soc Rep	73,77,520.00	10,30,79,600.00
5	Pakistan Ir	45,91,450.00	7,73,67,400.00
6	Namibia	22,05,000.00	3,56,55,800.00
7	Taiwan	16,05,100.00	3,27,64,717.00
8	Egypt A Rp	15,85,477.00	2,63,51,700.00
9	Indonesia	17,23,000.00	2,57,16,100.00
10	Belgium	10,58,000.00	2,53,80,260.00

Source: APEDA AgriXchange

Figure 3: Export from India Volume (MT) and Value wise (USD) 2013-14



As shown in the figure above the exports for Bajra has a declining trend from 2014 mostly due to increased requirement in house in animal feed and also use in malting industry. Pearl millet can be

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malted and used wholly or partially in place of sorghum malt in the traditional or industrial brewing of opaque beer. However, the small size of the grain is a disadvantage in large-scale industrial malting plants.

1.3. State Scenario: Rajasthan

Rajasthan has the highest area under Bajra with the highest production in the country. The state occupies nearly 4.43 million ha area with average production of about 3.63 million tonnes and yield of 818 kg/ha as in 2013-14.

The semi-arid and arid parts of the western Rajasthan are important for bajra cultivation. Jodhpur, Barmer, Nagaur, Bikaner, Churu, Ganganagar, Sawai Madhopur, Alwar, Kota, Tonk, Jhunjhunu, Pali and Jaisalmer are important districts where the crop occupies 30-60% of the total cropped area.

The crop is grown as a sole crop as well as mixed crop or inter-cropped with legumes or sesame in the state. It is also grown as irrigated green fodder during summer. Major production constraints are low spread of improved varieties/hybrids, poor seed establishment and low plant population, poor weed control, lack of adoption of agronomical practices, recurrent droughts and negligible area under irrigation (3 to 7%).[7]

Table 8: Area, Production and Productivity of Bajra in Rajasthan (2013-2014 to 2014-2015)

State	Area		Production		Productivity	
	(In ' 000 Hectare)		(In ' 000 Tonne)		(In Kg./Hectare)	
	2013-2014	2014-2015	2013-2014	2014-2015	2013-2014	2014-2015
Rajasthan	4434.60	4076.90	3627.50	4456.10	818.00	1093.00
India	7810.70	7318.00	9250.10	9184.20	1184.00	1255.00
Analysis	56.78	55.71	39.22	48.52	-366.00	-162.00
	% Share to total production in India				Productivity of Rajasthan w.r.to. India	

Source: Ministry of Agriculture & Farmers welfare, Govt. of India. (ON1151)

1.4. District and cluster scenario: Production

The major producing districts of Bajra in Rajasthan are Alwar, Jaipur, Jodhpur, Sikar and Nagaur57.42% of the states' total production. Following table details production volumes of top five districts.

Table 9: District-wise production Tonnes of Bajra in top 5 districts of Rajasthan FY 2015-16

S No	District	Production (in MT)	% Share
1	Alwar	467385	17.03
2	Jaipur	356962	13.01
3	Jodhpur	257656	9.39
4	Sikar	247451	9.02
5	Nagaur	246437	8.98
	% Contribution		57.42
	State	**2744271**	

Source: As per Grant Thornton's Analysis

[7] http://www.icar.org.in/files/state-specific/chapter/104.htm

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In catchment area

Bajra is part of the value chain intervention crop in 1. Bansur, 2. Dooni and 3. Bari clusters under RACP project.

Alwar is the top Bajra producing district in the catchment districts having (467385 MT) production. The production share of the catchment districts in the total state production of Bajra is 49%.

Total Production in the catchment Area in MT (2015-16)	1344833
Total Production in Rajasthan in MT (2015-16)	**2744271**
Percentage share in the State Production	49%
Top Producing Districts in the catchment zone	Alwar, Jaipur, Nagaur, Dholpur and Sawaimadhopur

The top 5 Bajra producing districts in the catchment area are given below:

Table 10: Top Bajra producing districts in RACP Clusters

District	Production (in MT)	% Share in State production
Alwar	467385	17.03
Jaipur	356962	13.01
Nagaur	246437	8.98
Dholpur	178135	6.49
S.Madhopur	95914	3.50
% Contribution		49.01
State	**2744271**	

Table 11: List of RACP cluster districts with Bajra Production figures (2015-16)

Sr. No.	District in the Catchment Area	Production in MT
1	Alwar	467,385
2	Jaipur	356,962
3	Nagaur	246,437
4	Dholpur	178,135
5	S.Madhopur	95,914
6	Tonk	49,991
7	Ajmer	47,211
8	Bikaner	27,073
9	Jaisalmer	26,275
10	Ganganagar	2,373
11	Bundi	1,483
12	Baran	1,197
13	Banswara	68
14	Chilttor	46
15	Kota	42
16	Jhalawar	10
17	Pratapgarh	2
Total Production in Catchment district Area		**1,500,604**

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Table 12: APP and ten year average for state and Cluster districts

Region	Details	2014-2015	2015-2016	Average of 10 Years	Increase in area
State	Area	4,076,909	4,044,591	4,739,211	-865,818
	Production	4,456,123	3,211,656	4,220,252	-228,744
	Productivity	1,093	794	894	93
	% Area	23.06%	22.88%	26.81%	
Tonk	Area	41907	44985	52601.1	-7,985
	Production	61078	49991	62247	4,373
	Productivity	1457	1111	1198.3	250
	% Area	8.93%	9.58%	11.20%	
Dholpur	Area	83524	85045	79858.20	17,567
	Production	177854	178135	155888.20	64,104
	Productivity	2129	2095	1943.40	405
	% Area	54.49%	55.49%	52.10%	
Alw	Area	249996	262025	251886.00	29,811
	Production	520015	467385	452048.10	50,043
	Productivity	2080	1784	1799.20	-13
	% Area	44.95%	47.11%	46.54%	

The productivity of Bajra in Cluster districts is way ahead of state productivity. In case of Alwar and Dholpur, it is almost double the state productivity. Bajra is also a dominant crop in Alwar and Dholpur with almost 46 to 52% cropped area under Bajra production.

Table 13: APP data of representative cluster Bansur

Details	2014-2015	2015-2016	Average of 10 Years	Increase in area
Area	6747.02	6842.72	6558.773	684
Production	127606.64	136264	122557.9	22,207
Productivity	1786	1981	1883	71

Within the RACP clusters, the productivity of Bajra in Bansur almost matches with that of district productivity and is higher than the state productivity and National productivity. Reason being use of hybrid seeds mostly for Bajra.

Table – 14.1: Area, Production and marketable surplus for the Bajra clusters under RACP

Cluster	Area (Ha)	Productivity MT/Ha	Production (MT)	Marketable surplus (MT) @ 75%	Value of surplus Rs Lacs @ Rs 14000 per MT
Bansur	6558	1.88	12348	9261	130
Dooni	2237	1.35	3019	2264	32
Bari	2564	1.94	4981	3736	52
Total	11359	1.79	20348	15261	214

A total of 11359 Ha area is under Bajra cultivation under the three Bajra value chain clusters producing around 20348 MT of Bajra. Out of this, around 25% is being retained by the farmers for self-consumption and for preparation of animal feed. There is a marketable surplus of 15261 MT whose marketable value would be Rs 214 lacs.

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Table-14.2: Resource mapping – Bajra

Cluster	Major mandi/s around cluster	Distance from major cities nearby	Major Markets	Warehouses/ Cold store with Capacity	No of FPCs targeted
Bansur	Alwar, Khairtal, Khedli, Kothputli	55 kms from Alwar, 142 kms from Gurgaon	Alwar, Behror, NCR, Kothputli Neem-ka-Thana	Bansur – CWC-3500 MT, SWC-30,050 MT,	2
Dooni	Tonk, Malpura, Deoli, Niwai, Uniyara	38 kms from Tonk, 68 kms from Niwai	Tonk, Niwai, Kota, Ajmer	2500 MT - SWC	2
Bari	Bari, Dholpur	30 kms from Dholpur, 65 kms from Bharatpur, 43 kms from Morena,	Bharatpur, Dholpur, Morena, Gwalior, Agra	3350 MT SWC	2

1.5. Approach to Value Chain Analysis

In order to evaluate the value chain of Bajra, consultations were held with major stakeholders in the chain including farmers, Consumers, Processors, traders, supporting public and private service providers and institutions etc. in various parts of the state. Major Bajra producing clusters were considered for survey within Rajasthan.

Table 14: Surveyed Major stakeholders for Value chain Analysis of Bajra (Annexure-1)

Surveyed Markets for the Value Chain Analysis	
Within and outside Rajasthan	• Farmers each in Bansur, Deoli, Bari, Bundi, Bonli and Mokhampura cluster • Nine • Five traders • Six government officials • Five government officials (Agriculture and KVK) • Four others

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Chapter 2- Pre Harvest Management

2.1. Major Commercial Varieties Grown in Rajasthan

Bajra is one of the important kharif cereals grown extensively in arid and semi-arid regions of the state. The area under the crop sometimes exceeds 50 lac ha during the monsoon season. To cater the need of the farmers high yielding composite namely Raj 171 and hybrids viz., RHB 90, RHB 121, RHB-127, RHB 173 and RHB 177 have been developed in the state, which are resistant to downy mildew and have bristles on ear heads for protection from bird damage, suitable for cultivation in arid and semi-arid regions of the state. The hybrid RHB 154 has been developed for low rainfall (below 400 mm) areas of the Country (A1 Zone). RSSC is the major supplier of bajra seeds for various government programs and demonstrations through Department of Agriculture. However, the ten-year trend analysis suggests there is a de growth in the sales of Bajra Seeds of RSSC except during 2010-11 and 12-13. This is an indication that farmers are more inclined towards the seeds supplied by private companies like Pioneer seeds, Proagro, JK, Kaveri and Dhanya. These companies are major players in Rajasthan in terms of Bajra seeds. Farmers generally prefer hybrid seeds for Bajra. Table 15 shows various hybrid varieties available in Rajasthan market for sale to farmers.

Figure 4: Ten year trend analysis of bajra seed sale of Raj seeds

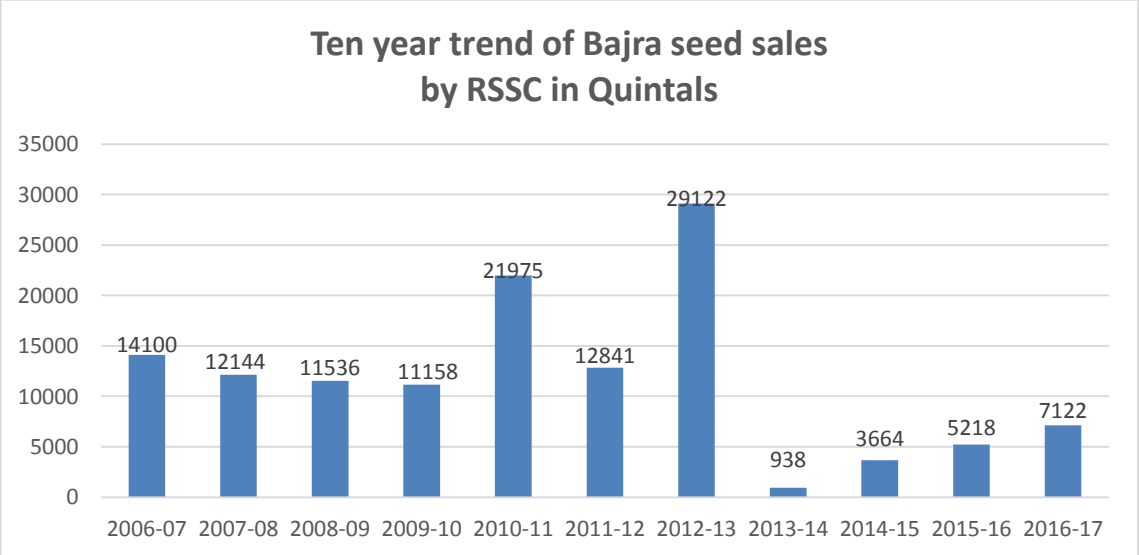

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Table 15: List of major varieties of hybrid seeds available in Rajasthan market for Bajra

Name of Company	Seed variety	Packing size	Market price Rs/kg
Pioneer seeds	86M84	1.5 kg	300
	86M88	1.5 kg	300
Proagro	9450	1.5 kg	300
	9444	1.5 kg	300
JK Seeds	JK 36	1.5 kg	300
Kaveri	Super boss	1.5 kg	300
Dhanya seeds	Dhanya bajra	1.5 kg	300
Local brands		1.5 kg	250

From the above table, it is seen that, all hybrid seed varieties available on the market are in packaging size 1.5 Kg as recommended per acre and offer a productivity of around 12-15 quintals per acre. While, the dealer margin for top branded seeds is around Rs 20-30 per kg, that of the local varieties is almost Rs 50-60 per kg.

2.2. New initiatives and Practices

Rajasthan has seen an increasing use of farm machinery. The use of machines is high in the major crop producing areas of southern and eastern districts of the state. However, there is a need to push mechanization around the bajra productivity clusters under the project. There are opportunities in production and sales of machinery for land preparation, moisture retention, seed fertilizer drills, plant protection, harvesting implements and packaging. Most of the farmers resort to broadcasting of bajra seeds and line sowing using seed drills can be a new intervention. Currently the recommended dose of Bajra seeds is 1.5 kg per acre but farmers generally apply around 2-2.5 kgs per acre and there is a scope to reduce seed rate through RACP interventions.

Seasonal Availability Pattern

Table 16: Seasonal Availability

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
						Sowing			Harvesting		

2.3. Land preparation

2 to 3 harrowing followed by a ploughing is required to make the soil in the field to the fine tilth. Any weeds should be destroyed during the field preparation to accommodate proper sowing and distribution of seed at appropriate depth.

2.4. Sowing/Planting/Consumption

Seed Treatment

The organo-mercurial compound Ceresan, Agrosan should be used at 2 – 3 kg per hectare to control seed borne diseases.

Seed rate and spacing in Pearl millet cultivation as follows: 3 to 3.5 kg/ha for dibbling method. 5 to 5 kg/ha for drilling method. Row spacing of 40 cm to 45 cm should be maintained and within rows, 10 cm – 15 cm should be kept.

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Table 17: Seed rate and distance

Row width (Inches)	Seed/foot of row	Seed/acre
30	9 to 10	2.6
24	8 and 9	3
18	6 to 7	3
14	4 to 5	33.1

Optimum planting time should be early October to November, and this is greatly dependent on the intended use. Soil temperatures should be at least 18 °C. Planting in cooler soils can cause problems with reduced emergence and greater competition from weeds. Plant densities should be similar or slightly higher (100 000 to 175 000 plants/ha) than for sorghum. Seeds should be planted into a firm, mellow, moist seedbed. As the Pearl millet seed is small, shallow planting is recommended to obtain good seed-to-soil contact.

2.5. Climatic and Soil Requirement

Pearl millet grows well in dry and warm climatic conditions and is a drought tolerant crop which requires low annual rainfall ranging between 40 cm to 60 cm. Ideal temperature for bajra cultivation is between 20 °C to 30 °C. Moist weather is advantageous during its vegetative growth. In North India, Bajra is grown as a kharif crop and in some southern parts, is grown as a summer crop providing irrigation.

Bajra can be grown in wide range of soils. However, it thrives best in black cotton soils, sandy loam soils having well drainage. This crop does not prefer acidic and water logging soils. Avoid saturated soils for its cultivation. It grows successfully well in soils with low pH (or) high salinity. Bajra can be easily grown in regions where other cereal crops like wheat or maize would not survive. 8

2.6. Nutrients Management

Bajra requires less nutrients. If you are cultivating commercial hybrid bajra, adding Farm Yard Manure (F.M.Y) or Compost result in better yield and quality of seed. Apply these organic manures at the time of soil or land preparation so that the soil become fully decomposed by the time of sowing. 90–100 kg of N: 50-60 kg of P: 50-60 kg of K is recommended for hybrid variety. Fertilizers should be applied in split doses. At the time of sowing, full phosphorus and potash and half of nitrogen should be added as basal application. 1/4 th nitrogen should be added after 30 and 60 days (after sowing).

2.7. Water management

Bajra grows well in dry and warm climatic conditions and it's drought tolerant crop which requires low annual rainfall ranging between 40 cm to 60 cm. Little is known about Pearl millet's response to irrigation during growth. Irrigation can improve stand establishment if the soil is dry during and after seeding. It appears that Pearl millet responds less to irrigation than other grain crops. Greatest water use occurs during the bloom and soft dough stages.

[8] 4/13/2017 Bajra Cultivation Information (Pearl millet) Guide (http://www.agrifarming.in/bajracultivation/)

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2.8. Pest & Disease management

Grain Pearl millet is not difficult to grow as it hosts few insect pests. The principal insect problems in millet production are chinch bug, stinkbug, nematode and birds. Normally insecticides are not needed on Pearl millet.

Chinch bug

The female chinch bugs lay eggs, in summer, that hatch into nymphs within two weeks. The nymphs begin to suck the sap from host plants. The chinch bug inserts its straw-like mouthparts into the plant tissue and sucks out the plant sap while injecting chemicals into the plant which clog the vascular system. The area around the feeding puncture usually turns yellow. Damaged areas first appear as small, irregular patches which enlarge as the insects spread.

Control: Inspect fields every 5 to 7 days until heading. Dusting of melathium4% or quinolphos 1.5% @20-25kg/ha.

Stinkbugs

Stinkbugs require control on developing grain heads. These insects are most active when Pearl millet is planted from July to August. Stinkbug feeding causes small and shrivelled seeds. Economic yield loss may occur when 15% or more of the grain heads are infested. Through their needle like mouthparts, they suck out the plant sap and inject their saliva. As a result, plants become stunted and fruit discoloured. Some plant diseases are also transmitted.

Control: Stinkbugs can be controlled by Dusting of melathium 4% or quinalphos 1.5%@20-25kg/ha.

Nematodes

Pearl millet hybrids differ in their resistance to nematodes. Primary damage from nematodes is to the roots of the plant. The degree of injury to the roots varies with the age of the plant when attacked. Symptoms are most severe when the feeding occurs during the first few weeks after planting. In general, symptoms consist of greatly reduced root systems with short, stubby roots having dark, shrunken lesions, particularly at the tips. If the root tip is destroyed, new roots may be produced above the damaged area, resulting in a high-rooted appearance. Plants which are not severely damaged by the initial feeding may recover and produce near-normal yields under optimum growing conditions.

Control: It is recommended to rotate Pearl millet with nematode resistant crops. Carbofuram 3% application @20-25kg/ha at the time of sowing.

Bird damage

Birds readily consume Pearl millet seed off the plants in the field. Losses can be severe in small fields or when harvest is delayed for an extended period after maturity.

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Control: Crop monitoring, early planting and timely harvesting are essential to minimise bird damage.

Disease control

Diseases in Pearl millets are not widespread. The most important diseases include mildew, seed rot, rust and grain moulds. Mildew and seed rots can be controlled with recommended fungicide treatment at planting.

Consult the label prior to using the product. Rust can be a major problem of Pearl millet. Planting early will minimise yield and grain quality losses owing to rust because rust is a late-season 7 disease. Early planting will allow the crop to mature before disease develops. Fungicide applications are not recommended for Pearl millet. Grain moulds develop when grain fill and maturation occur in wet or humid conditions. Grain moulds may reduce the quality of the grain. It is important to harvest the grain as early as possible after maturity, because some grain moulds will increase if harvest is delayed.

Cultural practices

Diseases in Pearl millet can also be controlled by certain sound cultural practices. The following cultural control practices have been found to be economically feasible in reducing disease losses. Growers should properly identify the diseases that limit production and then use a variety of controls in combination. Rotation with unrelated crops is probably the most utilised cultural practice for disease control. This helps keep population of pathogens from building up to damaging numbers. One should not expect rotation to eliminate disease development, but it certainly aids in reducing damage from most diseases. Fertiliser usage may have some bearing on the development of certain diseases. It differs with each crop and each disease but, in general, nitrogen out of balance with other nutrients enhances foliar disease development and predisposes some plants to other diseases. Potash, on the other hand, helps reduce disease development when it is in balance with other elements. Deep burial of crop residue helps to control certain diseases by placing the organism contained in the residue at a depth where there is an oxygen deficiency. This reduces the population of the disease-causing organism and permits the crop to escape much of the damage. Planting on a raised bed is helpful in preventing certain diseases such as Southern blight and certain of the wilt diseases. Burning of crop residue has been discouraged because of destruction of valuable organic matter and creation of an air-pollution problem.

However, the fact remains, that it is a highly effective means of eradicating some disease-causing organisms associated with crop residue. Undesirable plants that might serve as a host reservoir for virus diseases should be removed. Infected rhizomes of Johnson grass are the primary overwintering host for the maize dwarf mosaic virus that attacks grain sorghum, forage sorghum and maize. Removal of diseased plants is often an effective method in helping reduce the spread of a destructive disease. Virus diseases of stone fruit and bacterial wilt of cucurbits are examples where rouging is worthy of consideration.

2.9. Weed control & Inter culture operations

Good weed control is necessary for successful Pearl millet production, and is particularly important to control early emerging weeds. Preventive control options begin with planting clean, weed-free

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seeds. In addition, producers should make sure that all equipment used to plant millet is free of weed seeds. Controlling weeds along ditch banks, roadsides, and field margins will also help prevent weed seed from entering the fields. Mechanical controls should be used to prepare the seedbed prior to planting millets and where millets are planted in rows for seed, they give producers a head-start on weed control.

Because Pearl millet is planted relatively late, two pre-plant tillage operations are recommended, first to stimulate germination of weed seeds, then, several days later, to kill off weed seedlings prior to planting. If planted in wide rows, row cultivation for weed control should be planned, especially if herbicide control is ineffective. Gap filling or thinning is followed. Applying Atrazine @ 0.5 kg/ha works well to control weeds.

2.10. Recommended Good Agriculture Practices

Table 18: Crop Stage wise IPM

Pre-sowing*	
Common cultural practices:	• Deep ploughing and soil solarisation to expose pupae and propagules of soil borne pathogens.
	• Timely sowing should be done.
	• Field sanitation, rogueing
	• Destroy the alternate host plants
	• Soil test based application of manures and fertilizers.
	• Adoption of crop rotation.
	• Sowing of healthy, disease free and certified seeds
	• Uproot and burn infected plants early enough to avoid spread of the disease.
	• Avoid high plant populations
	• Adopt ecological engineering by growing the attractant, repellent, and trap crops around the field bunds.
	• Use well decomposed FYM @4t/acre or vermi-compost @ 2.0 t/acre treated with Trichoderma @2.5kg/ha at the time of last ploughing or at the time of growing.
Nutrients	• Apply vermicompost at1 week before sowing and FYM at 3-4 weeks before sowing.
	• Do not leave FYM or compost exposed to sunlight as nutrients may lose.
	• At the time of field preparation, adopt stale seed bed technique.
Weeds	• In Striga affected fields, do not grow pearl millet or sorghum continuously and follow crop rotation with legumes.
Downy mildew, Smut** and Nematodes	• Use tolerant/resistant varieties e.g. MH 1192,ICMH 451,Pusa 23, MBH 110, PHB 57, WC-C 75, ICTP 8203 and GHB 67
	• Eliminate any potentially damaging insect problems
	. • Plant in a row of 15 inches to 24 inches. Seed may be placed about 6 inches apart within the row.
	• The seed should be planted shallow, about half inch deep at the rate of 2 Kg/acre.
	• Maintain good fertility levels, apply adequate organic manures
	Biological control:

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	• Application of neem cake @ 80 Kg/acre for nematode control.
	Chemical control:
	• Spray with fungicidesmetalaxyl8%+ Mancozeb64%WP@800g in 200 l of water/acre for downy mildew.
	• Seed dressing with fungicides metalaxyl-M 31.8% ES@ 2.0 ml/Kg seed for downy mildew
Ergot**	• Dipping the seeds in 10% NaCl salt solution for 10 minute to control the ergot disease.
	• The crop should be sown as early as possible during June- July with the onset of monsoon.
	• Use of resistant cultivars is the most cost-effective method for the control of Ergot disease.
	• Eradicate the weeds like Cenchrus ciliaris and Panicum antidotale from around pearl millet fields.
	• Eradicate the weeds like Cenchrus ciliaris and Panicum antidotale from around pearl millet fields.
Sowing*	
Common Cultural Practices	• Use healthy, certified and weed free seeds.
	• Timely sowing should be done.
	• Line sowing should be done to facilitate inter-culture operations. • Early sowing to avoid the active period of shoot fly population
	• Removal of diseased crop residues
	• Crop rotation
	• Seed treatment should be done with Azotobacter/ Azospirillum and PSB @ 200 g /acre and VAM inoculum @ 1Kg /acre.
Nutrient	• If soil test recommendation is not available follow the blanket recommendation of NPK @ 28:14:14 Kg/ acre for varieties. For hybrids, apply 32 Kg N, 16 Kg P_2O_5 and 16 Kg K_2O per acre.
	• Apply the recommended N in three splits as 25:50:25 per cent at sowing, 15 and 30 days after sowing and full dose of phosphorus and potassium at sowing.
	• Under rainfed conditions with low rainfall, the dose of fertilizers should be reduced to 50 percent and applied at the time of sowing.
	• Plant population should be maintained to its optimum right from beginning to minimize the crop weed competition.
Weed	• Inter cropping with short duration pulse crops like moong bean should be done to suppress weeds between rows.

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	• Inter cropping with pigeon pea in 2:1 ratio is also recommended for weed suppressing.
	Cultural control:
Shoot fly**	• Set up the low cost fish meal traps @ 4/acre till the crop is 30 days old.
	Mechanical control:
	• Removal of the seedlings with dead hearts and keep the optimum plant stand in the field.
	• Plough after harvest to remove and destroy the stubbles.
	Biological control:
	• Avoidance of monoculture.
Downy mildew	• Avoidance of low lying fields and water logging.
	Biological control:
	• The crude extract of Vincarosea, Ocimum sanctum, Allium sativum, Datura stramonium, Azadirachta indica and Thuja sinensis can reduce the disease incidence.
	Chemical control:
	• The systemic fungicide metalaxyl-M 31.8% ES was used for seed treatment 2.0 ml/Kg seed successfully to control downy mildew in pearl millet.
	• Spray metalaxyl 8%+ mancozeb 64% WP@ 800g/acre in 200 l of water
	• Spray metalaxyl 8%+ mancozeb 64% WP@ 800g/acre in 200 l of water
Note: Apply Trichoderma viride/harizanium and Pseudomonas fluorescens as seeds/seedlings/planting material treatment and soil application (if commercial products are used, check for label claim. However, biopesticides produced by farmers for own consumption in their fields, registration is not required).	
Vegetative Stage*	
Common Cultural Practices	• Select and grow varieties resistant to stem borer.
	• Sow the lab or cowpea as an intercrop (Pearl Millet: Lab lab 4:1).
	Common mechanical practices:
	• Remove and destroy the disease affected plants
	• Dead hearts should be pulled out and used as fodder or buried in manure pits.
	• Stubbles should be ploughed up during winter and burnt to destroy the hibernating larvae
	• Apply remaining 50% dose of N at 15 days after sowing and 25 % N at 30 days after sowing as top dressing with irrigation or immediately after rainfall.

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Nutrients	• **Inter cultivation:** Two weeding with one shallow hoeing up to 4-5 weeks after sowing will keep the field free from weeds.
Weeds	• First weeding/ hoeing should be done within three weeks of sowing.
	• Mulches like straw hay, crop residues etc. can be used in between the rows to suppress the weed growth.
	• As mentioned above in the sowing stage.
Downy mildew	**Biological control:**
Cutworm	• See common practices.
	Cultural control:
Stem borer**	• See the common cultural practices
	Mechanical control:
	• Follow common practices.
	Biological control:
	• Follow common biological practices.
	• Follow common biological practices.
Flowering heading*	
Grain Midge**	• Removal of Johnson grassy weed.
	Cultural control:
Hairy caterpillar**	• Irrigate once to avoid prolonged mid-season drought to prevent pre-harvest infestation.
	Mechanical control:
	• Dig the trenches of 1 inch depth between the fields & dust the trenches to kill the larvae in pits.
	Biological control:
	• Spray Bacillus thuringiensis @ 400 g/acre.
	Cultural control:
Ear head bug**	• See the common cultural practices.
	Biological control:
	• Spray NSKE 5%
	• Azadirachtin 1%
	• For others see common practices.
	Cultural control:
Rust**	• See the common cultural and mechanical practices
	Biological control:
	• Some fungal species controls rust disease such as Aspergillusglobosum, Chaetomium globosum and Trichoderma koningii.
	Cultural control:
Smut**	• Avoid rationing.
	• Intercropping of mungbean with pearl millet reduces the smut disease.
	Mechanical control:

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Birds	• Use bird scarer
	Biological control:
	• Apply NSKE 5% on panicle to save the damage from birds
	• Apply NSKE 5% on panicle to save the damage from birds

2.11. Harvesting

Maturity Grains can be harvested as early as 40 days after flowering. When the crop is ripe and dry, grains will pop out cleanly when the head is pinched. You can also begin to harvest when the seed moisture content drops below 15%, but artificial drying to 10 to 12% moisture after harvest is needed to prevent storage moulds. Matured seeds range in colour from white to brown, blue to almost purple. Most are slate grey.

Pearl millet can be harvested by hand, using a knife or sickle. The heads are then dried in heaps on the ground or threshing floor. It can also be harvested by using a combine harvester. Combine harvesting must be adjusted to properly thresh the small seed of Pearl millet. Harvesting for silage is well-suited to mechanical harvest and it should be done when heads appear.

2.12. Pre Harvest

- Cultivation on marginal lands;
- Unreliable rainfall tends to keep the use of inputs such as fertilizers to a minimum;
- Loss of crop due to downy mildew and bird damage;
- Limited commercial demand depresses the incentive to use purchased inputs.

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Chapter-3: Post-Harvest Management

3.1. Post - Harvest Losses, Harvesting Care and Post – Harvest Equipment

The losses at farmers' field are generally because of crop damage, improper harvesting techniques, poor packaging, and poor transportation. Around 5-8% is lost during post-harvest period due to attack of birds, fungal infestation, damaged/ immature grains and due to losses in transportation and handling in APMC. In case of handling through local commission agents, further 1% is lost due to improper handling. In the APMC premises, 3-5% is lost during transportation, weighing, unpacking, re-packing and auction handling process. At the processors' door step 3-5% is lost during processing due to wastage, pilferage and moisture loss. Therefore, care is required to clean and remove or separate the contaminants from the produce so that the cleaned produce is free from sand (soil), small stones, leaves, shrivelled seeds, off-type seeds, broken seeds, glumes, sticks, chaff, parts of stems, insects, animal hair, animal excreta (e.g. rat and insect faeces) and more annoyingly, metal pieces. Sometimes, even the threshed grains are spread out on bare ground for drying. The separation effect is best obtained when it is slightly windy, so that the wind current blows the light contaminants from the relatively heavy grains (personal experience).

At the farm gate, around 10 kg of threshed bajra grains are placed in a tin or basket and poured from above the head to fall on to the ground usually lined with either a carpet or canvas. The wind blows off the chaff leaving a heap of clean grains. This method is much faster than the traditional winnowing. However, the method is not effective in separating sand, stone and metal contaminants and a set of sieves is used to separate abnormally small grains from the good ones. Screening also removes sand particles and broken pieces of millet grains.

Packaging

After threshing, drying and cleaning, millets are usually bagged in to 80-100 kg bags and sealed ready for transportation to distant markets (personal experience). Sometimes millet grains may be packed in bags sewn from artificial polythene bags for either transportation or storage.

Storage facilities

Table 19: Storage Facilities

Storage Facilities	Particulars
Producers' storage	Producers store Bajra in bulk at farm Godowns or own houses using various types of traditional and improved structures. Generally, these storage containers are used for short periods. Different organization/institutions have developed improved structures for Bajra storage with various capacities like Hapur Kothi, Pusa bin, Nanda bin, PKV bin, etc. Different storage structures are also used for this purpose like bricks-built rural

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Storage Facilities	Particulars
	godown, mud stone godown etc. Producers also use flexible PVC sheets covering for temporary storage. Some producers also pack Bajra in jute gunny bags or in gunny bags lined with polythene and stack in room.
Rural godown	Considering the importance of rural storage in marketing of agricultural produce, the Directorate of Marketing and Inspection initiated a Rural Godown Scheme, in collaboration with NABARD and NCDC. Its objective is to construct scientific storage Godowns with allied facilities in rural areas and to establish a network of rural godown in the States and Union Territories. Up to 31-12-2002, construction of 2373 godowns were sanctioned through NABARD and NCDC with the total capacity of 36.62 lakh tones. In addition, 973 Godowns with storage capacity of 0.956 lakh tonnes were sanctioned under renovation and expansion.
Mandi godown	Most of the Bajra is moved to the market after the harvest. Generally, Bajra is stored both in bulk and in bags. The APMCs constructed storage godown in the market yards. At the time of keeping produce in godown, a receipt is issued indicating the kind and weight of produce stored. The receipt is treated as a negotiable instrument and is eligible for pledge finance. The CWC and SWCs were also allowed to construct godowns in the market yards. Co-operative societies also constructed godown in the market yards.
Central Warehousing Corporation (CWC)	CWC was established during 1957. It is the largest public warehouse operator in the country. In March 2002, CWC was operating 475 warehouses in the country. It has 16 regions, covering 225 districts, with a total storage capacity of 8.91 million tonnes. Apart from storage, CWC also offers services in the area of clearing and forwarding, handling and transportation, distribution, disinfestation, fumigation and other ancillary services like safety and security, insurance, standardization and documentation. The CWC has also introduced a scheme, called the Farmers' Extension Service at selected centers to educate farmers about the benefits of a scientific storage. The CWC is also operating 109 custom bonded warehouses with a total operating capacity of 6.95 lakh tonnes as on 31-03-2002.These bonded warehouses are specially constructed at a seaport or airport and accept imported commodities for storage till the payment of customs duties by the importer of the commodities. Annexure 2
State Warehousing Corporations (SWCs)	Different States have set up their own warehouses in the country. The area of operation of the State Warehousing Corporations is district places of the State. The total share capital of the State Warehousing Corporations is contributed equally by the Central Warehousing Corporation and concerned State Government. The SWCs are under the dual control of the State Government and the CWC. At the end of December 2002, SWCs were operating 1537 warehouses in 17 States of the country with the total capacity of 201.90 lakh tonnes. The State-wise storage capacities with SWCs as on 31-12-2002 are given below. Annexure 3
Cooperatives	Cooperative storage facilities are provided to the producers at cheaper rates, which reduces the storage cost. These cooperatives also provide pledge loan against the produce and storage is more systematic and scientific than traditional storage. Financial assistance and subsidies are provided by Government organizations/banks to build cooperative storage.

Post-harvest losses, post-harvest equipment

It has been estimated that about 6 to 8 % of Bajra is lost at farmers' level during harvesting, threshing, winnowing, transportation and storage.

3.2. Grade Specification& Grading at Producer level

Grading is the process of sorting of produce according to the grades or classes. In the case of Bajra, the quality factors such as moisture content, foreign matter, other food grains, admixture of other varieties, damaged grains, immature grains, and weevil led and shrivelled grains are considered while

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grading. In order to improve the quality of produce and obtain better price, farmers clean the Bajra with sieves to remove the dust, broken grains and small size shrivelled grains etc. The buyers offer the price on the basis of visual inspection of the lot or available sample considering above mentioned quality factors.

Specifications under AGMARK:

Under the Agricultural Produce (Grading and Marking) Act 1937, the national standards for Bajra are notified, considering the quality factors like a) moisture, b) foreign matter, c) other food grains, d) admixture of different varieties, e) damaged grains, f) immature grains, and g) weevil led and shrivelled grains. **Grade Designation and Definition of Quality of Bajra**

A) General characteristics:

Bajra shall:

- Be the dried mature grains of Sorghum vulgar peers raised in the Rabi season;
- Be sweet, hard, clean, wholesome, uniform in size, shape, colour and in sound merchantable condition
- Be free from added colouring matter, moulds, weevils, obnoxious substances, discoloration, poisonous seeds and all other impurities except to the extent indicated in the schedule;
- Uric acid and aflatoxin shall not exceed 100 mg and 30 micrograms per kilogram respectively;
- Be free from rodent hair and excreta;
- Comply with the restrictions in regard to pesticides/insecticides residue (Rule 65), poisonous metals (Rule 57), naturally occurring toxic substances (Rule 57-B) and other provisions prescribed under the Prevention of Food Adulteration Rules, 1955 and as amended from time to time.

Note:

(i) In foreign matter, the impurities of animal origin shall not be more than 0.10 per cent by weight.
(ii) Ergot affected grains shall not exceed 0.05 per cent by weight in damaged grains.

B) Special characteristics:

Grain Designation	Maximum limits of tolerance (% by weight)						
	Moisture	Foreign matter		Other Edible Grains	Damaged Grains	Immature and Shriveled Grains	Weevilled Grains
		Organic	Inorganic				
Grade I	12.0	.10	Nil	1.0	1.0	2.0	.5
Grade II	12.0	.25	.10	1.5	2.0	4.0	1.0
Grade III	14.0	.50	.25	2.0	3.0	6.0	2.0
Grade IV	14.0	.75	.25	4.0	5.0	8.0	6.0

Grading at producer's level and under AGMARK:

Grading under AGMARK is carried out by the Directorate of Marketing & Inspection in accordance with the grade specifications notified by the Govt. of India under the provisions of Agricultural Produce (Grading & Marking) Act, 1937 and rules made there under. The Directorate of Marketing & Inspection has prescribed the grade standards for Bajra.

The scheme, grading at producer's level, was introduced in 1962-63 by the Directorate of Marketing

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& Inspection (DMI). The main objective of the scheme is to bring quality awareness among the producers and offer quality produce for sale. Under the scheme, the produce is subjected to simple tests and assigned a grade before sale. The program is being implemented by the State Governments through the Agricultural Produce Markets. In India, till 31.3.2006, 2051 grading units were set up. During the year 2005-2006, about 103452.60 tonnes of Bajra valued at Rs. 6278.24 lakh was graded at producers' level.

3.3. Major storage Disease and Pest and their Control Measure

Table 20: Major storage pest and control measures

Sr. No.	Name of the Pest	Damage	Control
1	Rice weevil Sitophilus oryzae (Linn.)	Adults and larvae both bore into grains and feed on the grain.	Two types of treatments are followed to control infestation. A) Prophylactic treatment: Use following insecticide to prevent infestation in godown and stock of Bajra/rice. 1. Malathion (50 percent EC): Mix 1 litre in 100 litre of water. Use 3 litre prepared solution per 100 square Meter Area. Spray every 15 days interval. 2. DDVP (76 percent EC): Mix 1 Litre in 150 litre of water. . Use 3 litre prepared solution per 100 square Meter Area. Do not spray on stock. Spray on walls and floors of the godown as and when required or once in a month. 3. Deltamethrin (2.5/WP): Mix 1 kg. in 25 litre of water. Use 3 litre prepared solution per 100 square Meter Area. Spray on Gunny Bags after 3 months' interval. B) Curative Treatment:Use following fumigation insecticide to control infested stock/godown of Bajrain airtight condition. 1. Alluminium Phosphide: For stack fumigation use 3 tablets / tonne and put polythene cover on infected stock. For Godown fumigation, use 120 - 140 tablets per 100 cubic meter area and keep godown structure airtight and closed for 7 days.
2	Lesser grain borer Rhizopertha dominica (fabr.)	Beetles and larvae both penetrate the grain and feed. Sometimes, larvae feed on the waste flour produced by the adults. Heavy infestation makes the grain warm and moist, which leads to mould formation. It eats mainly Bajra kernels but may also damage milled rice.	
3	Khapra beetle Trogoderma granarium	Larvae is a very serious stored pest but the beetle itself does not damage. First the larvae feed germ portion and later other parts of the grains.	
4	Saw-toothed grain beetle Oryzaephilus surinamensis (Linn.)	Both beetle and larvae feed broken grains and damaged grains of other insects. They are usually found as a secondary pest together with other grain pests.	
5	Red rust/Confused flour beetle Triboliumcastaneum (Herbst.) Triboliumconfusum (J.du V.)	Beetle and larvae both do not cause damage to whole grain but feed on broken and damaged grains produced by milling and handling or infested /damaged grains of other insects.	
6	Tropical warehouse moth Ephestiacautella	The moth is usually found in warehouses. The larvae feed on damaged or processed grains leaving the whole grains undamaged. In heavy infestation, larvae cover all	

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Sr. No.	Name of the Pest	Damage	Control
		available surface with webbing.	
7	Rice moth Corcyra cephalonica	Larvae feed broken and processed Bajra/rice. Larvae produce dense webbings. Whole grain kernels are bound into lumps.	
8	Rodents	Rodents eat whole grains, broken grains, flour etc. They spill more grains than they consume. Rodents also contaminate Bajraby hair, urine and feces, which cause diseases like cholera, food poisoning, ringworm, rabies etc. They also damage the storage structures and other accessories of storage like wire and cable etc.	Rat cage: Different types of rat cages are available in the market. Caught rats can be killed by dipping into water. Poison baits: Anti-coagulant pesticide like Zinc Phosphide is mixed with bread or any other food stuff used as bait. Keep baits for a week. Rat burrow fumigation: Put tablets of Aluminum Phosphide in each hole and burrow and block that hole by mud mixture to make it airtight.

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Chapter 4- Cost of production and Net value accruals to producers

A typical farmer surveyed in the cluster area has 1.6 ha are deployed for Bajra production. The gross yield per acre is 18 quintals per ha. The market rate on the sale is about Rs. 1400 per quintal or Rs. 14 kg or Rs.25200 per ha. The cost of cultivation is about Rs. 15350 per ha. Net realization is about Rs. 9850 per ha. Out of total expenses made, about Rs. 4000 is made on cost of land preparation, seed cost is about Rs. 1500, fertilizer and pesticide cost is about Rs. 2800, weeding related (labour cost) is about Rs. 3200 and harvesting cost is about Rs. 3200. Packing cost is Rs. 25 per 100 kg or about Rs. 450 per ha. Transportation cost to mandi is about Rs. 200 per ha- all totalling around Rs. 15350 per ha. Seeds are mostly bought from GSS/local retail shops. Fertilizers are bought from GSS and pesticides from local input shops. The produce is sold in nearby APMC.

Table 21: Cost of cultivation of Peal Millet in Rajasthan

Sr. No.	Particular	Amount (in Rs. Per ha)
A.	**Income (18 qtls/ha @ Rs 1400/ qtl)**	**25200**
B.	**Cost of Production**	
1	Land Preparation Cost	4000
2	Seed Cost	1500
3	Input Cost	2800
4	Weeding Cost	3200
5	Harvesting Cost	3200
7	Packing and Transportation Cost	650
	Total Cost of Production	**15350**
C	**Net Profit per ha without fodder**	**9850**
D	**Fodder value @ Rs 300 per quintal for 36 quintals/ ha dry fodder**	**10800**
	Total net earnings of farmer inclusive of fodder	**20650**

Source: Farmer interviews. Taken case of an average farmer.

Fodder is an important income for Bajra farmer as the yield of dry fodder is around two times the yield of grains. However, most of the fodder is being stored by farmers for animal feed and hence the real earning from fodder might vary widely from farmer to farmer. In case of bajra, the production cost per unit of output is low due to high productivity owing to large scale adoption of hybrids, low water requirement and the net margin realized per unit is also modest. Bajra is also a major fodder crop for the farmers in Rajasthan.

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Chapter 5- Supply Chain of commodity

5.1. Seasonal Availability

In India, Bajra is shown as a Kharif crop. Sowing normally takes place between last week of june to first half of july depending upon arrival of rains. Harvesting starts from early October to early November. The market arrivals start from October onwards.

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
						Sowing			Harvesting		

5.2. Market Arrivals & Prices in Major Markets of Rajasthan

Major arrival months Bajra in mandis of Rajasthan are from September to December.

Table 22: Seasonal availability of bajra and price pattern in khairthal mandi (arrivals in MT and prices Rs/qtl)

Year	2014		2015		2016		2017	
Month	Arrival	Price	Arrival	Price	Arrival	Price	Arrival	Price
Jan			29549	1150	27181	1370	49009	1400
Feb			27064	1100	27796	1450	29442	1350
Mar			37079	1120	25585	1520	38091	1330
Apr	17414	1250	19526	1150	20280	1550		
May	8469	1250	9379	1100	5228	1650		
Jun	3016	1160	8100	1120	2060	1520		
Jul	4008	1150	6370	1170	1568	1500		
Aug	2548	1200	11983	1150	2008	1535		
Sep	70220	1150	104142	1200	205300	1275		

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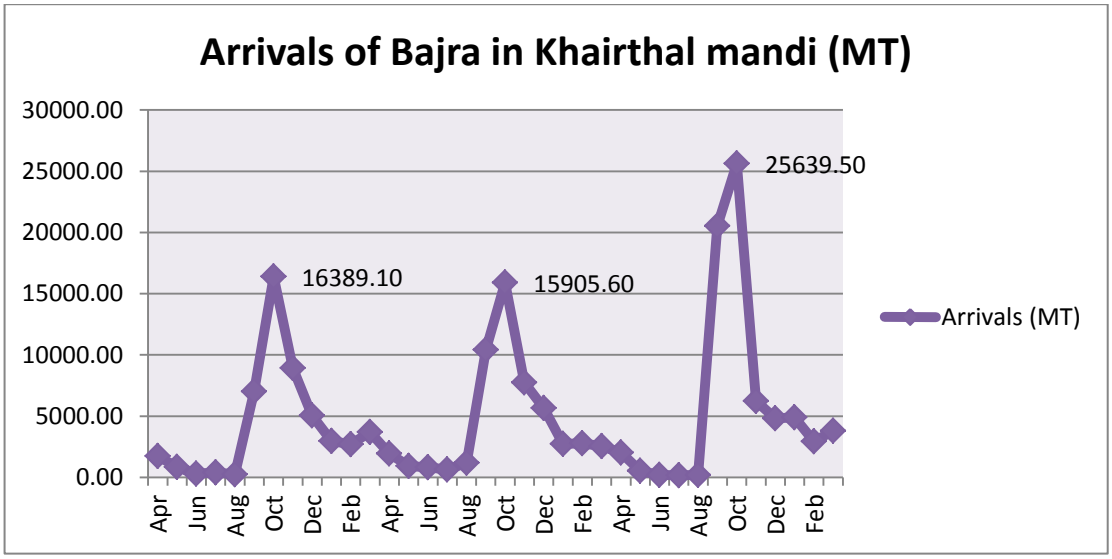
Year	2014		2015		2016		2017	
Month	Arrival	Price	Arrival	Price	Arrival	Price	Arrival	Price
Oct	163891	1050	159056	1220	256395	1250		
Nov	89312	1080	77478	1270	62252	1420		
Dec	50567	1100	56561	1370	48253	1400		

Figure 5: Arrivals of Bajra in Khairthal mandi



The arrivals of bajra coincides with the consuming season i.e. it is mostly consumed in winter both for human and animal consumption. Most of the arrivals start from the end of September and continue till end of November. Major mandis for Bajra in Rajasthan are Alwar, Bharatpur, Khairthal, Jaipur, Dausa, barmer, Jodhpur and Hindaun.

Farmers sell their produce are local mandi, APMC, wholesaler, retailers and sometime also by government when price in the market goes below MSP. Among all four destinations, more than 50 % farmers sell their produces in local mandies/APMCs and rest of all sales to the wholesaler, retailers and government [9]

[9] http://hope.icrisat.org/wp-content/uploads/2013/10/Market-oppotuiinity-for-pearl-millet-in-NW-India1.pdf

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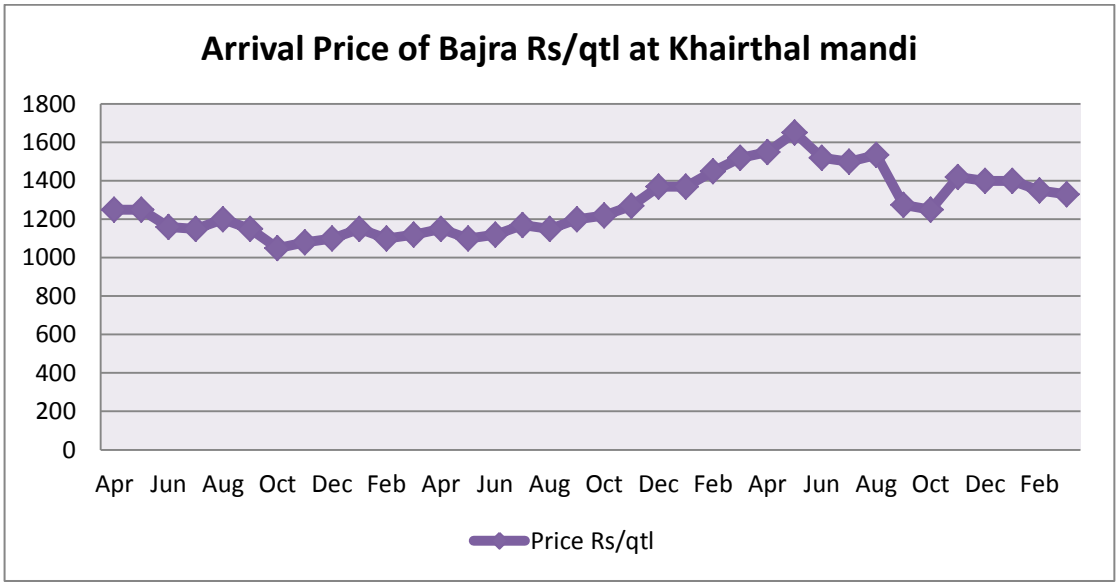
Figure 6: Price of bajra in Khairthal mandi over last three years (13-14, 14-15 and 15-16)



The average price of bajra has seen an upward trend from around Rs 1100 per quintal in 2014 to Rs 1400 per quintal in 2017.

5.3. Existing value chain- Bajra

Existing value chain for bajra (P.T.O.) involves basically three production-distribution or activity-marketing channels, namely one related to food processors and the two other related to feed processors. Presently, village traders and the mandi largely facilitate aggregation of produce and sell it at the mandi. Producers suffer from want of storage and grading and sorting facilities and value accruals are limited. Farmers generally sell Bajra to local traders or in the mandi if it is nearby. From APMC level, the channel divides into two, one for food and one for feed industry. The food industry has limited applications of bajra. The retail sale of whole grain in case of bajra is negligible for human consumption as it is not a predominant food grain in urban areas. However, in rural areas mostly farmers, bajra is a major winter cereal crop but most of the grain used is from in-house production. In channel 2, animal feed processors use bajra in various proportion with other food grains like maize. In channel 3 Bazra has also its market in the international market such as in Yemen, Saudi Arab and other Gulf Countries where it is used as animal feed.

Post harvest loss is a major issue in the current value chain as around 12-18% of Bajra is lost during storage, transportation and handling. Care has to be taken to reduce the post harvest loss. Various support institutions in the current value chain include D.O.A, KVKs, SAUs, ATC, CWC/SWC various financial institutions. The consumers are mostly Animal rearers who depend upon the crop for animal feed.

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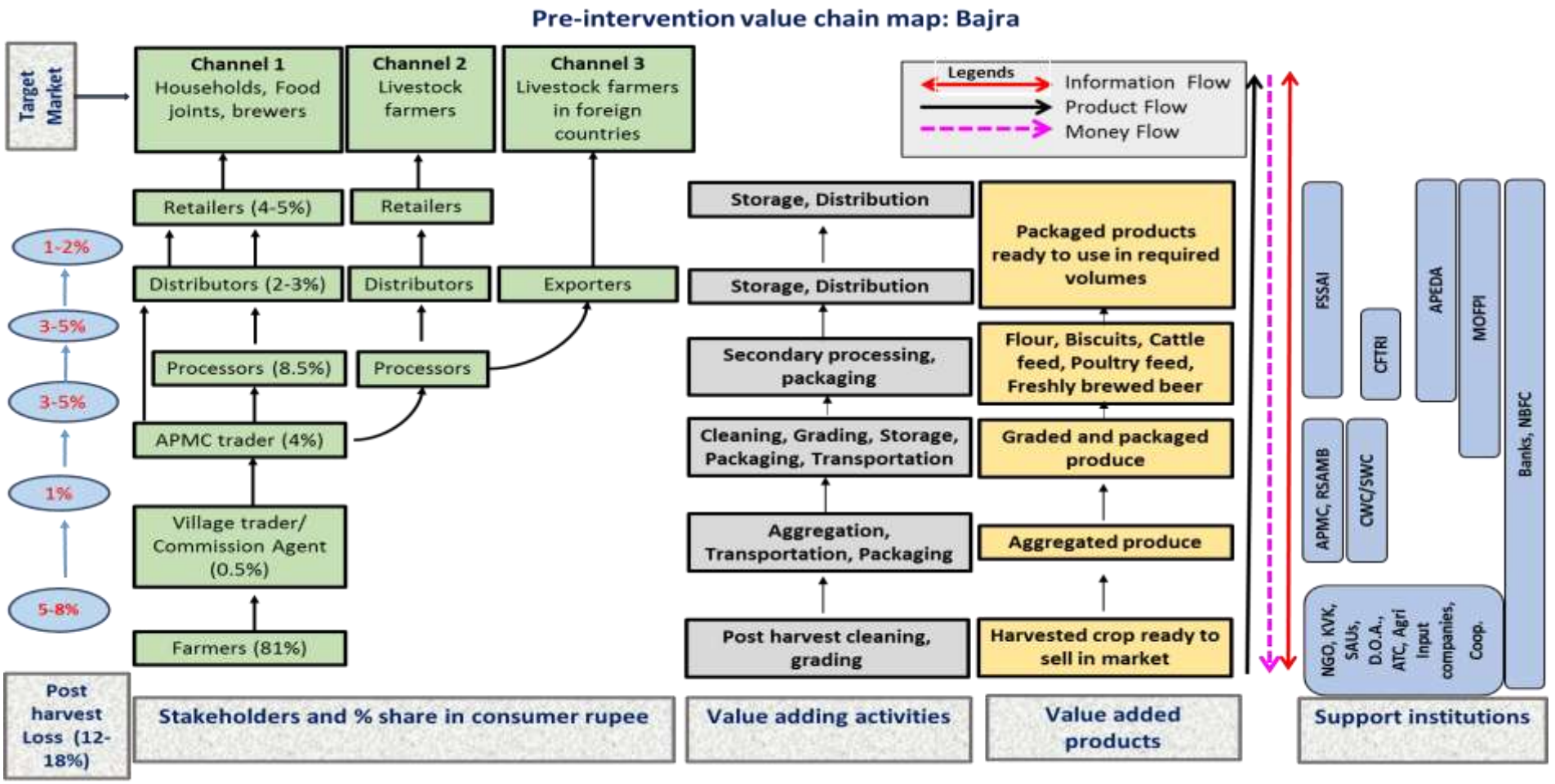
Figure 7: Pre-intervention value chain of Bajra



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Marketing Cost

Marketing costs are the actual expenses incurred in bringing goods and services from the producer to the consumers. The marketing costs normally include:

- Handling charges at local points
- Assembling charges
- Transport and storage charges
- Handling charges by wholesaler and retailer

Market fees, commission charges and taxes on Bajra in Rajasthan are described in table below.

Table 23: List of market fees

S. No	Particulars	Charges (%)
1	Mandi tax	1.6%
2	Commission charge	2%
3	Tax	---
4	Miscellaneous charges (Handling, weighing, loading, unloading, cleaning etc)	It varies from market to market. In bagru mandi Rs 6-7 is the loading and unloading charges per quintal
5	Overall addition to purchase price from farmer	5%

Marketing margin

Total marketing margin is cost involved in moving the Bajra from producer to consumer and profit of various market functionaries. Absolute value of the total marketing margin varies from market to market, channel to channel and time to time. Generally, traders from mandi undertake onward supply adding 2% margin to bulk handlers and animal feed units.

5.4. Alternative Systems of Marketing

5.4.1 Direct Marketing

Direct marketing initiatives are on to a limited extent in some commodity value chains in Rajasthan. In case of Bajra, village level commission agents and APMC are the main route.

5.4.2 Contract Farming

Contract farming in case of bajra has very little potential as there is abundant arrival of bajra during harvesting season and most of the mandi arrivals are of hybrid varieties with larger grain size than local breeds. Hence most processors prefer procurement from APMC. Procurement of Bajra by government through FCI, NAFED and NCDEX at MSP is an example of direct marketing. NAFED is a government authorized agency. It procures Bajra directly from farmers at MSP for government. In 2012 to 13, NAFED purchased 366895.77 MTs of various food grains like Bajra, Barley, Barley, Paddy, Rice and Maize at Rs. 504.88 crore in its outright account. During 2012 to 2013, total Bajra procured by NAFED is 2154.57 MTs of value 240.78 lakhs. There is no any private market that purchases Bajra directly from farmers in Rajasthan.

5.4.3 Private market yard

NCDEX has started to offer world's first bajra supply contract for the benefit of Indian farmers from 2014. Farmers can sell their bajra through NCDEX portal. There are no private market yards

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in different clusters where bajra is significantly produced such as Bansur, Deoli, Pisangan and Sangod. However, two major companies from Rajasthan like Star Agri Warehousing Ltd. and CGR Collateral Management Ltd. have taken licenses to operate their warehouses as Private Market Yard. CGR is also a signatory of MoU with State Government of Rajasthan during GRAM, Kota and is keen to work with project farmers for offering their warehouses as Private market yard near to production centres from where farmers can store and sell their produce without going to Mandi. They are also offering 75% loan against warehouse receipt of bajra to farmers.

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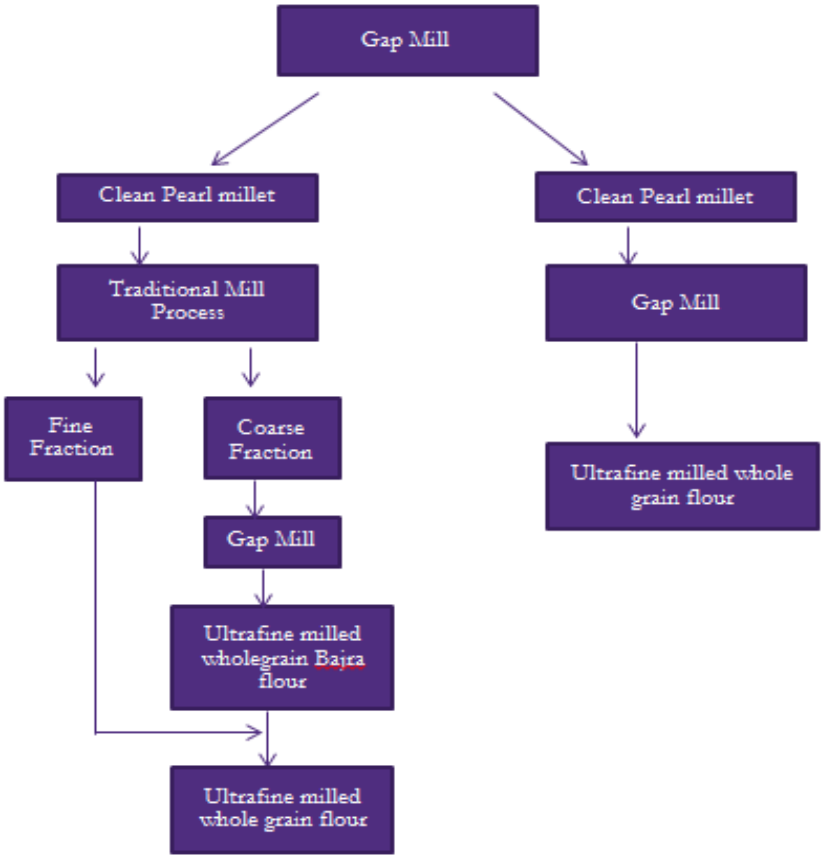
Chapter 6- Processing Infrastructure availability and utilization

6.1. Processing

Bajra Flour:

Milling process (cracking) results in high starch damage suitable for water absorption to make dough. The milling process also minimizes loss of Ash.

Figure 8: Process Chart for Bajra Flour GAP mill (Gap mill is a fine grain pounding mill)



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The process of making roasted Bajra is as under-

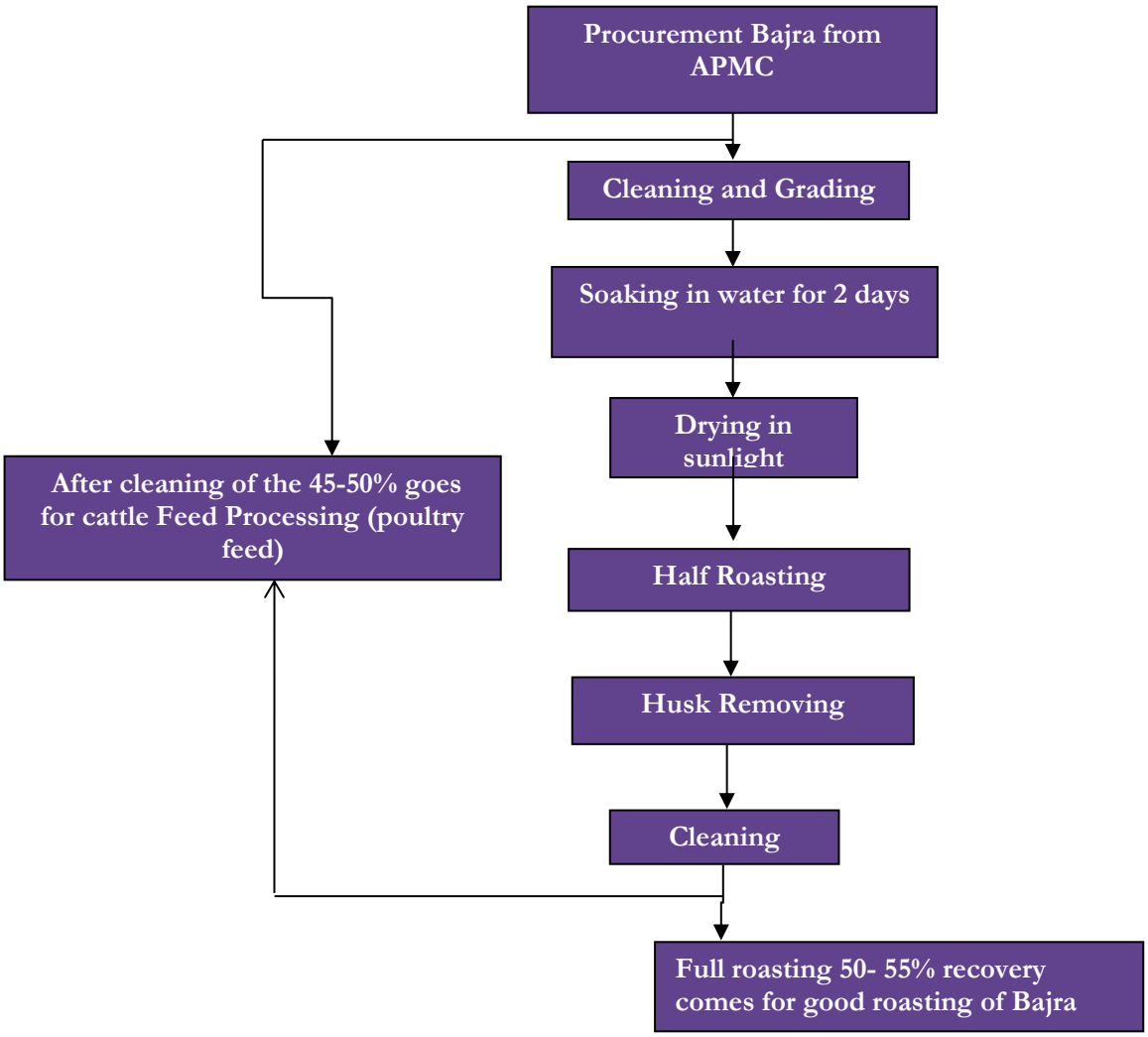
The entire process (shown below) is of 7 days. The roasted bajra is sent for mixing to make various variants of Bajra like-

1- Multigrain mixture- Rice poha, Bajra, Gram, Wheat poha, jowar, soybean

2- Panchratan mixture- Bajra, peanut, gram, wheatpoha, cornpoha

3- Plain roasted bajra masala

Figure 9: Roasted Bajra Flow Chart



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6.2. Stakeholder's Share in Consumer Rupee

The price spread along with margin accrued at every stage of value chain starting from the farmer till retailer is shown in the table given below.

Table 24 Price spread table

Activity	Value per Quintal (Rs.)	Stakeholders' share in consumer Rupee (% to MRP)
Retailing: Sale by retailer to consumer	About Rs. 1716 per quintal which makes a profit margin of 4%	3.85
Wholesaling: Sale by wholesalers to retailers	Rs. 1650 per quintal with a margin of 2%	1.92
Processing: Sale after primary processing to wholesalers	Rs. 1617 per quintal (Gross value on sale with net profit margin in processing 4%)	8.57
APMC: Sale upon trading at the Mandi	Rs.1470 per quintal (1.6% mandi tax, 2% commission, all total 5% inclusive)	4.08
Production: Cost of production is Rs. 16375/ha or Rs 409/quintal	Rs. 1400 per quintal excluding fodder (Gross value on procurement) Gross value accrual to producers after cultivation costs is Rs. 991	81.59

In case of Bajra, the margin for retailors of whole grains is limited. However, the margins multifold with processing of bajra into various food products like biscuits and multigrain atta. The existence of a long chain of middle men including the APMC and related commission agents, producers share in consumers' rupee is adversely affected. This mirrors the need for promotion of contract farming options eliminating/minimising the role of the APMC. However, the limitations in contract farming policy & statutes merits correction.

6.3. Price build up & Marketing Efficiency Analysis

The price spread and values accrued to stakeholders across the chain reflects the profit margins of the accrued to different stakeholders. Much of the value accruals are accrued to processors and retailers. Generally in case of sale of bajra grain, farmers share in consumer rupee is 81.59% (Rs 991 profit), trader – 4.08% (Rs 70 margin), processor-8.57% (Margin Ra 147), wholesaler – 1.92% (Margin 1.92%) and 3.85% (Rs 66 margin).

In case of processed Bajra like Bajra flour and biscuits, the share of farmer would reduce almost to around 40-455 and balance margin would be re-distributed among traders and processors.

6.4. Consumer preference Analysis

From the interviews with various consumers, it was found that urban dwellers in Rajasthan like to take bajra roti atleast 5-8 days in a month during the winter season and mostly in dinner. Among the farming community, bajra roti is consumed almost every day in dinner in winter. Bajra generally has very little infood grade industrial application. However, use of bajra in malting industry is in an increasing trend. Bajra is also an important ingredient in animal and poultry feed in winter season.

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Chapter 7- Existing Institutional support and Infrastructure facility

7.1. Support at cultivation stage

A range of support institutions support value chain activities as described below.

7.1.1. Department of Agriculture, Govt. of Rajasthan:

The department has various verticals through which it supports production, productivity and market linkage in the state. It has a well-established structure and network of State/District and panchayat level officials to provide extension services to farmers. The department issues licenses to various agri-input marketing companies including seeds, fertilizers and insecticides and ensures quality assurance to farmers through regular reporting from suppliers and random quality checks of agri inputs. The licenses are issued first at the State level by registering input/service providers. The registered companies can only supply inputs to district and regional level distributors who in turn make availability of the products at the retailors. All handlers of agri inputs and produce have to take license from competent authority either at district or state level. Similarly, the department also issues mandi licenses for traders at different APMCs for trading in specific commodities. The same are described below.

A. Extension vertical:

- **Extension support**: The extension wing recommends good agricultural practices for various crops as per various agro-economic zones, promotes seed replacement through distribution of Minikits containing improved variety of seeds. It also provides grant support of upto 50 percent of the price of notified varieties of less than 10 years or Rs 1500 per quin whichever is less. For hybrid varieties subsidy is - 50% of the price of seeds notified for less than 10 years or Rs 5000 per quin whichever is less. The department also provides upto 50% subsidy on micro-nutrient (50% of total cost or upto Rs 500/ha) and bio-fertilizer application (50% of total cost or Rs 300/ha) under various schemes viz. National Agriculture Development Scheme/ National Composite Safety Mission/ National Food Security Mission. The application can be submitted to the office of Agriculture Supervisor-Asst. Agriculture Officer/ Asst. Director (Extn.)/ Dy. Director (Extension) by eligible farmers at Panchayat/Sub-district and District level respectively. Under the head "Subsidy on Crop Demonstrations", subsidy upto Rs 5000/ha is available for bajra cultivation through flagship programs like State Plan/NFSM.
- **District level farmer help desk**: Under this head, farmer help line are established at district level with nomitated district level officials from the office of Dy. Director, Agriculture

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Extension to support farmers on various farming related problems. Apart from this, a state level help desk is also maintained whose telephone no is 0141-5102578

- **Agriculture information dissemination**: At the state level, technical dissemination is being done through the daily newspapers, agricultural papers, monthly publication of "Kheti Ri Bataan" bulletin is also being done. Apart from this, information about advanced agricultural methods of major crops during crop season, publishing posters, agricultural guides on various topics, and Rabi / Kharif package of practice books at the block level and farmers, people's representatives and farmers by producing farmer friendly literature. Is being distributed to the institutions related to. From day-to-day basis to all the radio stations of the state, from 7.45 to 8.15, share the information related to farming and phone in these programs is being broadcast on Tuesday, Thursday and Saturday. The program is being sponsored by the Department of Agriculture on Monday, Tuesday and Wednesday for three days a week. "Farming" program on Doordarshan- produced by the Agriculture Department, is broadcast from Doordarshan Kendra, Jaipur on every Thursday from 7.30 am to 8.00 pm. In this program, information about departmental schemes / programs being executed by the Agriculture Department, discussions with experts, problem-solving, confusion-solving, fortnightly work, message, success stories, innovation, short films, eclipse etc. The tax program is made simple, interesting and farm-making. The technical information on agriculture and related subjects to the farmers has been done by the Indian government to provide "Kisan Call Center" in the state through telephone. Farmers can get any kind of information related to farming by making free calls to phone number 1800 180 1551/1551, from basic / mobile telephone to 6.00 pm to 10.00 pm.

- **Water use efficiency promotion:** Under the Farm Pond Program, rain water harvesting is promoted with the provisioning of 50% subsidy or maximum amount of Rs 52,000/- on raw farm pond and Rs 75,000/- on farm pond with plastic lining whichever is less. This scheme is available under the Rashtriya Krishi Vikas Yojana.

  For Dighi construction (under National Agriculture Development Scheme/RKVY), 50% of the unit cost or 350 / - per cubic meter filling capacity and 50% of the cost of the unit cost, on the construction of plastic lining (raw) diggings, by constructing a minimum of 4.00 lakh liters of Filler capacity and more than 50% of the unit cost. The amount of rupees 100 / - per cubic meter will be filled up or maximum Rs 2.00 lakh, whichever is less the grant will be payable.

  For Water Houze construction under the national Agriculture Development Scheme, support is provided for areas where deep water is used for irrigation. For constructing a minimum of one lakh liters of Fill Capacity water shed Houz for all categories of farmers, 50 percent of the unit cost or Rs. 350 / - per cubic meter fill capacity or maximum Rs. 75000 / - whichever is less is the subsidy element.

  Under the irrigation pipeline head (of National Agricultural Development Plan, National Food Security Mission, NMOP) water use efficiency is promoted for irrigation water. Under this scheme, PVC / HDPE of prescribed size for carrying water from source to farm on irrigation pipeline is supported. On the purchase of pipes, the farmers of all categories are given 50 percent of the cost or maximum amount Rs. 50 / - per meter on HDPE pipes or Rs. 35 / - per meter on PVC pipe or Rs. The maximum amount of Rs.15000 / - on the 20 / - per meter HDPE laminated le-flat tub pipe will be payable, whichever is less proportionate.

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Under the Fountain Irrigation program through National Food Security Mission; Pulses and Wheat - Under the Fountain Irrigation Program, subsidy is 50% or the amount is Rs. 10000 / - per ha, whichever is less.

Under the Mobile Raingun support program, for irrigation of grains and pulses crops, subsidy of 50 percent of the cost under the Mobile Renganization program or Rs.15000 / - per unit whichever is less, grant is payable. This subsidy is available under the NFSM scheme

- **Agricultural equipment grants distribution program**: Grants upto 40 to 50 per cent are given as per the category of farmers on the purchase of approved agricultural machinery viz. Seed cum Fertilizer Drill, Plow, Threser etc.
- **Gypsum distribution program**: 50% Subsidy is given to farmers on district wise rate of Gypsum for maximum area of 2 hectares. This support is for soil reclamation of alkali soils.
- **Plant protection inputs:** Segment, viz. Plant Protection Chemicals / Bio Agents / Bio Pesticides / Pheromone Trap / Liyos Distribution, including weeds in crops; 50% of the price or Rs. 500 any less per hectare is payable as subsidy.
- **Plan Protection equipment segment:** Human transport * (napsek, foot sprayer, duster etc.) are given 40-50 percent of the cost or maximum 600-800 / - Per device as subsidy. Under Power Drives egment * (Nepasek Power Sprayer) are given 50-60 percent of the price or maximum 3000-3800 / - Per device. For tractor mounted sprayers, 50% of the price or Rs 10,000 per device is subsidized. These schemes are as per targets allotted for respective districts.
- **Assistance for area specific integrated farming systems** like livestock based, horticulture based and tree based farming systems: Assistance is provided for farmers of selected village/cluster having land from 0.25 to 2 ha area per farmer. It is implemented on cluster basis with 100 ha of land. Subsidy applicable is: 50% of cost or 52500/-for farm pond, 50% of cost or 468/-per SQM for green house, 50% of cost or 30/- per SQM for low tunnel, 40% of cost or 800/-per colony for bee keeping, 50% of cost or 15000/-for diesel pump, 50% of cost or 50000/-for vermicompost unit Pucca @ 125/ per cubic ft, 50% of cost or 8000/-for HDPE vermi bed
- **Organic production:** Organic bajra also has a great potential. For support under the head, Promotion of Organic Farming, subsidies are available for heads like Conversion of land Cropping systems and organic seeds, traditional organic input production unit, botanical extracts production unit, use of phosphate rich organic manure, construction of vermicompost pit, use of liquid bio fertilizer and support for packing labelling and branding material support are subsidized for consecutive two years at a rate specified in the manual.
- **Prime-minister Crop insurance scheme:** Farmer have to pay 2% of insured amount in Kharif, 1.5% of insured amount in Rabi and 5% of insured amount in horticulture & commercial crops, subject to maximum of 7 hectares per farmer. Rest of the premium amount will be borne by central and state government in equal ratio. Beyond 7 hectares, farmer has to pay whole premium amount, i.e. without any subsidy.
- **Soil health card:** Under this, component, district level soil and water testing labs support farmers on soil testing and providing soil health card for integrated nutrient management.

B. **Rajasthan State Seed Production and Certification agency** helps in ensuring production of certified seeds for farmers. The department is mandated to; Recognize varieties eligible for Seed

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Certification and annually publish lists indicating the names of such varieties, Maintain a list of sources of Breeder & Foundation seeds approved by the Central Seed Certification Board, Outline the procedure for submission of application for growing, harvesting, processing, labelling and tagging of seeds intended for certification, Undertake inspection of seed fields, seed processing plants and lots in accordance with the procedures outlined by the Central Seed Certification Board in accordance with Indian minimum seed certification standard (IMSCS), Regulate the processing of seeds at seed processing units and Ensure that the seeds certified by it conforms to the standards prescribed by the Central Seed Certification Board. Thus the department ensures availability of quality seeds for growers.

C. **Rajasthan State Seeds Corporation** helps availability of quality seeds at affordable prices through the cooperative network and private distributorship channel under the trade name "Raj Seeds". During Rabi and Kharif seasons Rajseeds are made available at the door steps of the farmers through Beej raths operating at almost every panchayat samitee of the state. The department sold around 7122 quintals of bajra seeds in Kharif 2016-17.

D. **Rajasthan Kisan aayog (Rajasthan State farmer Commission):** It is mandated to Investigate and review of agriculture and allied sectors, keeping in mind the economic ecology and environment for sustainable development of agriculture and To inform the State Government for taking necessary measures to solve timely problems of agriculture, animal husbandry and fisheries, so that farmers can be protected against difficult situations, Talk to different farming organizations / associations to make the government aware of their demands and suggestions and To bring the difference in demand and supply to the attention of the State Government, so that its adverse effects are not on the peasantry.

E. **State Agricultural Management institute (SIAM), Durgapura Jaipur:** The institute is mandated to organize training programmes on functional areas of Agriculture and its allied sector namely; Induction courses on fresh recruitees, Refresher courses for in service officials, Crop production technologies, Management of Technology and Input, Irrigation Management, Dry land Farming, Crop Economics, Extension technique, Communication skills, National Workshop / Seminars etc.

F. **Agricultural Conservation Testing Centres (ATCs):** The department of Agriculture has ten ATCs who are mandated to find out the usefulness of the research recommendations received from the agricultural research centres under the agricultural universities of the state in various agricultural and regional conditions and local conditions and to amend the tests in the research recommendations according to local conditions. On the basis of the tests, preparations of agricultural climatic package of practice and amendment of the advanced agricultural methods are amended. Apart from this, the agri-certified testing centres also solve the technical problems in the day-to-day work of the extension workers.

7.1.2. ICAR and allied institutions:

The Indian Council of Agricultural Research (ICAR) is an autonomous organisation under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Government of India. The Council is the apex body for co-ordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the entire country. With 101 ICAR institutes and 71 agricultural universities spread across the country this is one of the largest national agricultural systems in the world. The ICAR has played a pioneering role in ushering Green Revolution and subsequent developments in agriculture in India through its research and technology development that has enabled the country to increase the

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production of food grains by 5 times, horticultural crops by 9.5 times, fish by 12.5 times, milk 7.8 times and eggs 39 times since 1951 to 2014, thus making a visible impact on the national food and nutritional security. It has played a major role in promoting excellence in higher education in agriculture. It is engaged in cutting edge areas of science and technology development and its scientists are internationally acknowledged in their fields.

State Agriculture Universities (SAUs):

The state four major Agriculture Universities namely; 1. Swami Keshwanand Rajasthan Agricultural University, Bikaner, 2. Maharana Pratap University of Agriculture and Technology, Udaipur, 3. Sri Karan Narendra Agriculture University, Jobner, 4. Agriculture University, Kota and affiliated colleges who contribute to research, education, training and knowledge dissemination on agriculture technology. The Agriculture Universities also provide research and extension support through attached Krishi Vigyan Kendras and Agriculture Research Stations.

Following are the varieties of Bajra developed by various Agriculture Universities in Rajasthan.

Name of university	Variety of seeds developed
SKRAU Bikaner	RHB 90, RHB 30, RHB 58, Raj 171, Raj. Bajra Chari 2, RHB 121, RHB 154, RHB 173, RHB 177
SKNAU, Jobnear (Through ARS, Durgapura Jaipur)	High yielding composite varieties namely Raj 171 and hybrids viz., RHB 90, RHB 121, RHB-127, RHB 173 and RHB 177 have been developed, which are resistant to downy mildew and have bristles on ear heads for protection from bird damage, suitable for cultivation in arid and semi-arid regions of the state. The hybrid RHB 154 has been developed for low rainfall (below 400 mm) areas of the Country (A1 Zone).

Note: Much research has been done in the field of Bajra seeds but the same should reach to the farmers for their benefit. Research institutions should also therefore focus on commercialization of the varieties introduced by them so that private firms can take up their distribution.

Krishi Vigyan Kendras;

The State has 42 Krishi Vigyan Kendras affiliated through ICAR. The mandate of the KVKs is to: 1. Organize Frontline Demonstrations (FLDs) to establish production potential of various crops and enterprises on farmer's field (Facilitate technology dissemination from Lab to field) 2. To conduct on farm testing to identify the location specificity of agricultural techniques under various farming systems, 3. Organize need based training to farmers on agri and allied activities, 4. Production and supply of good quality seeds and planting materials and various farming products to the farming community and 5. Work as resource center of agricultural technology for supporting initiatives of private, public and voluntary sector for improving agricultural economy of the district. The KVKs also offer soil testing facilities to farmers.

Agriculture Research Stations: Apart from the above, there are several agriculture research stations and sub-stations attached to the universities to undertake research/trial and demonstration of agriculture technologies.

All India Coordinated Research Project on Pearl Millet (Bajra), ICAR, Jodhpur: Since its inception in a974, the All India Coordinated Research Project in Pearl Millet has developed production protection technologies specific to agro-eco regions of different states.

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Central Arid Zone Research Institute (CAZRI): To arrest this degradation process and for scientific and sustainable management of the resources, Desert Afforestation Station was established in 1952 at Jodhpur. This was later expanded into Desert Afforestation and Soil Conservation Station in 1957, and finally upgraded to Central Arid Zone Research Institute (CAZRI) in 1959 under Indian Council of Agricultural Research, New Delhi. The CAZRI operates through Six Divisions, located at the headquarters in Jodhpur. There are four Regional Research Stations located in different agro-climatic zones to work on location-specific problems.

7.1.3. Credit facilities: Agricultural credit facilities in the state has both formal and informal sources. Under the formal sources, various banks are extending credit facility at subsidized interest rates under KCC schemes for farmers having land title. The Gram Seva Sahakari Samitis run by Cooperative Department also extends crop loans to farmers. However, as many farmers live in hindu-undivided families, i.e. land title is still with father and sons undertake farming in their share of land as mutually agreed in the village panchayat. In such cases, getting a formal source of crop loan is difficult. Hence many farmers resort to informal sources of loans from village level money lenders at exorbitant rates and exploit them later by forcing to supply the produce also through the money lenders.

7.1.5. Agri input availability: A number of input service providers (in seeds, fertilisers and pesticides) operate in the important bajra producing clusters of Jaipur, Dholpur and Tonk districts. They are registered through the office of Dy. Director, Agriculture Extn. Of respective districts.

7.2. Support at post-harvest stage

Following are the major support institutions for post-harvest handling of agriculture produce in the state.

A. **Department of Agriculture marketing (DAM):** The department offers upto 50% subsidy on various sorting/grading machines as specified in the circular dated 19/07/2017.

B. **Post-harvest storage:** Department of Agriculture provides subsidy for metal storage bins to farmers. Apart from this, following storage infrastructure is available in the state.

- **Rural Godowns**: There are 139 rural godowns in Rajasthan which stores mustard, gram, wheat, bajra, gaur, soybean, groundnut etc. The list of godowns in Rajasthan that store bajra is attached in Annexure-5
- **Central Warehousing Corporation**[10]**:**
  The Central Warehousing Corporation (CWC) is the largest public sector warehouse operator with their godowns established in almost all the states of the country. At present, CWC have already established and operating more than 450 warehouses with a capacity of 93.25 lakh tonnes (as on 29/02/2004). These are scientifically constructed warehouses which facilitate the farmers to store their produce safely and to derive the benefit of pledge finance during the period of glut situation in the markets. (Annexure - 2 List out CWCs in Rajasthan)
- **State Warehousing Corporation:**
  State Warehousing Corporations (SWCs) were established in different states under the purview of concerned state governments and constructed godowns at distant places. The total share capital of SWCs is contributed equally by CWC and concerned state governments and SWCs under dual control. The SWCs also provide storage facilities for green gram. (Annexure – 3 Lists of SWCs in Rajasthan)

[10]Farmers' portal, CWC Link (http://farmer.gov.in/CWC_Link.aspx) (retrieved on April 9,2017)

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C. Market information through Agmarknet:

The Directorate of Marketing and Inspection (DMI), an attached Office of the Department of Agriculture, Cooperation and Farmers Welfare under Ministry of Agriculture & Farmers Welfare, was set up in the year 1935 to implement the agricultural marketing policies and programmes for the integrated development of marketing of agricultural and other allied produce in the country with a view to safeguard the interests of farmers as well as the consumers. It maintains a close liaison between the Central and the State Governments.

The Directorate is headed by Agriculture Marketing Adviser to Government of India and has its Head Office at Faridabad (Haryana), Branch Head Office at Nagpur (Maharashtra) and 11 Regional Offices at Delhi, Mumbai, Chennai, Kolkata, Hyderabad, Chandigarh, Jaipur, Lucknow, Bhopal, Kochi and Guwahati and the Central Agmark Laboratory at Nagpur[11]

D. Support on agri produce marketing through APMCs:

The state has 136 Krishi upaz mandi samitis (KUMS) and 310 market sub yards for trade of agriculture commodities. Among them, grain mandis in Jaipur, Ganganagar, Kota, Bikaner, Hanumangarh, Alwar and Sikar are major grain mandis in the state as far as Bajra is concerned.

These APMCs are intended to be responsible for:

- Ensuring transparency in pricing system and transactions taking place in market area;
- Providing market-led extension services to farmers;
- Ensuring payment for agricultural produce sold by farmers on the same day;
- Promoting agricultural processing including activities for value addition in agricultural produce;
- Publicizing data on arrivals and rates of agricultural produce brought into the market area for sale; and setup and promote public private partnership in the management of agricultural markets

E. Support on post-harvest value addition: The Farm Gate Agro processing and Agri-marketing scheme of Govt. of Rajasthan has provisioning for subsidy upto Rs 20 lakh for a sorting/grading/ value addition project of Rs 50 lakh. Ministry of Food Processing, Govt. **of** India also has a scheme in the name of Kisan Sampada (Backward & forward linkage scheme) through which there is a provisioning of 35% subsidy for Farmers/Farmer Groups for establishing value addition facility for agri produce.

[11] Agmarknet (http://agmarknet.gov.in/) (retrieved on April 9,2017)

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Chapter 8- Gap & Constraint Analysis

8.1. As Perceived by Producers and Other Stakeholders

Producer case illustration
Bajra

A typical farmer in Mokhampura cluster with about 4.8 ha land holding. About 1.6 ha are deployed to Bajra production. The gross yield per acre is 28 quintal per ha. The market rate on the sale is about Rs. 1400 per quintal or Rs. 14 kg or Rs.39200 per ha. The cost of cultivation is about Rs. 16250 per ha. Net realization is about Rs. 22825 per ha. Out of total expenses made, about Rs. 4000 is made on cost of land preparation, seed cost is about Rs. 1600, fertilizer and pesticide cost is about Rs. 2800 per acre, weeding related (labour cost) is about Rs. 3200 and harvesting cost is about Rs. 3200. Packing cost is Rs. 25 per 100 kg or about Rs. 700 per ha. Transportation cost to mandi is about Rs. 875 per acre- all totalling is around Rs. 16375 per ha. Fertilizer and pesticides are procured from local input supplier. The farmer sells selling produce at Bagru and Sambhar Mandi at price range of Rs 1,400 per quintal. Farmers in the region are not satisfied with the market price. Sometimes the production also gets reduced due to sudden change in climate. Sometimes the production also gets reduced due to sudden change in climate.

Some value Chain Constraints of bajra farmers:

- High production cost: Farmers have to purchase seeds and pesticides from local shops and they have not tried bulk purchase through groups. Hence their cost of production is higher. It was also observed that due to increase in cost of DAP, farmers are inclining towards usage of Urea fertilizers; which will eventually lead to soil deterioration.
- Lack of infrastructure: Farmers immediately sell their produce after harvest and there is no nearby storage facility to store Bajra. Also due to higher moisture content farmers get less price and sometimes below MSP.
- Malpractices in market: Traders often use moisture meters to check moisture in Bajra but farmers don't have trust on them, they feel that traders cheat them and offer less price to their produce.
- Lack of an alternate marketing channel: Farmers don't sell directly to local traders and they don't know quality parameters required for poultry feed and cattle feed. They also don't have infrastructure like dry yards, cleaning and grading and storage.
- Lack of market information: Farmers rely on nearest mandi for getting price information and sometimes they call traders to know day to day pricing.

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Figure 10: Discussion with Farmers at Pallu kalla (Mokhampura)

Processor Case Illustration

Vijay store is among the biggest and the finest handmade multigrain namkeen processors of Rajasthan. Shri Jagmohan Vijay took over the business 30 years back. It was started long back in year 1951 by his grandfather. Over the years Vijay store is offering more than 100 variants products by roasting 12 different kinds of commodities which include Bajara, Maize, Barley, Gram, Moong, moth, groundnut, Wheat and Soybean, flex seed with the brand name "Govindjee". Vijay store is situated at choti chaupar, Jaipur and it has a large processing unit in Vishwa Karma Industrial Area (VKIA). Roasting of grains are done at factory and multigrain mixtures are prepared at godown.

Bajra as raw material is procured from VKIA Kukerkheda, Agriculture Produce Marketing Committees (APMC) and Chandpole APMC with price of Rs. 1600-2500 per quintal. Cleaning, grading and packing are done in-house. The processing cost of roasting bajra is around 125% which seems very high. As per Mr. Vijay production cycle of roasting bajra is of 7 days and conversion is only 50% as we use only best quality grains at the last cycle of the production. Rest is sold out as seed and cattle feed.

Vijay store has two different marketing channels-

1) Wholesale- Packets of 15 kgs are made and sold at the price of Rs. 70-100 per kg. Roasted bajra is sold to almost all parts of India.

2) Retail- At the retail counter, the roasted bajra is sold with the brand name Govindjee in the packs of 200 gms with a price of Rs. 40-50 each or Rs. 100-125 per kg.

The roasted food is healthy for the human body and enriches with lot of protein supplements.

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8.2. SWOT analysis of the indicative Value Chain: Bajra

Strength	Weakness
• Bajra is one of the most extensively cultivated cereals in the world, after rice, wheat, and sorghum • In India alone, 90% of the world's and in Rajasthan 45 % of country's total bajra is grown. • Its tolerance to drought, heat and soil salinity along with its higher water use efficiency makes it a climate-smart crop. • It performs better than cereals in semi-arid regions. • It gives sufficient energy to the field workers at a very low cost. Thus it is called Poorman's food. It is rich in nutrients like iron and zinc apart from carbohydrate and protein. • It provides feed to large number of animals and grown for silage and hay purpose also.	• Bajra flour (prepared by pounding or milling) quickly goes rancid, and can be stored only for short periods. • It tastes bitter due to the presence of phenolic compounds • Limited processing units for bajra and its by-products such as flour units, roasted Bajra units, etc. • Inadequate grading & sorting facilities. • The production of the crop is seasonal, but its demand remains for a longer period. Thus, adequate storage facilities required. • Large number of intermediaries in the chain leads to low producer's income. • Lack of market information regarding prevailing prices, arrivals etc. force farmers to sell in village itself.
Opportunity	**Threat**
• Scope for tie up of FPCs through FCSC with firms like VSR, Patanjali, Moraraka Organic, etc. • Scope for facilitation of start-ups from amongst FPCs or individual entrepreneurs, in secondary processing of value added products of Bajra like flour, snacks, animal feed, roasted bajra, etc. • Scope for establishment of quality sorting and grading facilities by FPCs as part of Farmers Common Service Centre (FCSCs), along with facilities for packaging and vehicle to facilitate transportation. • Promote good agricultural practices with regard to planting, harvesting, use of inputs, disease management, pest control, etc. through FCSCs • FPCs to undertake joint input sourcing activities for seeds, fertilizers, pesticides, etc. under the umbrella of CFCs • Increasing use as roasted bajra and in malt shows better marketing opportunities	• Fluctuation (delay) in sowing due to climate change • Cloudy weather, rainfall at the time of flowering and seed formation (Adverse weather conditions) • Infestation of insect-pest & other disease • Taxation related policies (for example – proposed 5% GST on branded goods), etc. affects the price levels and buying patterns of consumers. • Adulteration Malpractices by competitors to get price advantage

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8.3. Key constraints in Bajra crop

The constraints observed under bajra are divided under from different categories, viz Production related constraints, Post-Harvest related constraints and Processing and market infrastructure related constraints.

8.3.1. Production related constraints:

Mostly the seed market is being captured by private companies who sell the seed upto Rs 300 per kg which is 20 times the cost of bajra grain. The research varieties developed by various institutions are not able to penetrate into the market system. Farmers would get benefited if the seed variety of RAJSEEDS is promoted more. Sowing of bajra is also mostly through broadcasting as the cost of line sowing is higher by around Rs 500. Seed rate is also higher for farmers as they do not follow recommended rate. Currently farmers are using 2-3 kg of seeds instead of the recommended 1.5 kg seed rate per acre.

8.3.2. Post-Harvest related constraints:

There is lack of Primary processing facility except sun drying in bajra at farm level.

8.3.3. Processing and market infrastructure related constraints:

Currently there is lack of primary sorting and grading infrastructure at community level forcing farmers to sell semi-graded produce to traders who later on sell it at a higher margin after doing sorting, grading and cleaning.

Lack of market intelligence services: Farmers do not receive information on market prices. Some farmers sell crops through village level traders, because due to which they are not realising fair price.

Lack of primary processing infrastructure:

i. There is a non-availability of facilities for primary processing: cleaning, grading & sorting at the farm level.

ii. There is no practice and provision of producer level storage.

iii. There is acute lack of awareness among farmers regarding FAQ (Fair Average Quality) standards.

iv. Farmers do not practice the usage of basic equipment like moisture meter and weighing machine.

Distant markets: Due to the distance of APMC from farmer's field, they resort to sell the produce to traders at non-competitive prices.

Seasonal price variations: Generally during harvesting period, prices are on lower side and reach highest after 5-6 months of harvesting. However, farmers do not have any option but sell immediately at lower prices as they need cash to meet out their expenses. They could realize higher price if they can hold the stock for 2-3 months.

Malpractices in markets: Many malpractices prevail in the markets of bajra i.e. excess weighment, delay in payment, high commission charges, delay in weighing and auction, different kinds of arbitrary deductions for religious and charitable purposes etc.

Infrastructure facilities: Due to inadequate infrastructural facilities available with the producers, traders, millers and at market level, the marketing efficiency is affected adv**ersely.**

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Agribusiness policy related constraints:

Contract farming: Rajasthan has adopted a model APMC Act, 2007. In Rajasthan Contract farming of desired variety and quantity as per buyer's/processor's need, has been allowed. Buyer/processors may supply inputs and technical know-how and farmers may produce the crop for sale to buyers at an agreed price. However, this price shall not be lower than minimum support price and title of land shall remain with farmer. Produce will be purchased at buyer/processor's business/factory place. But processors found less interested in registering under contract farming. Team ABPF discussed contract farming issues with some of the processors and related challenges are given below:

i. **Rule 5** – Each agreement shall be written on stamp paper of the value of Rs.100. This increases cost of procurement and procurement time.

ii. **Rule 9 –** Separate registration form shall be filled for each agreement. Large amount of paper work can be reduced by group registrations or procurement directly from FPCs.

iii. **Rule 17-**In case the contract farming buyer fails or refuses to purchase the agreed quantity of the agriculture produce from the contract farming producer, he is to pay the amount of the difference between the agreed price and the actual sale price of the contracted produce in the market committee concerned to the producer. Mutual termination of contract should be allowed.

iv. **Rule 19 –** The contract farming buyer need furnish an undertaking equal to 20% of the value of the contracted amount. This amount can be reduced and this will motivate big players to participate in contract farming.

8.4. PIESTEC Framework

Bajra can be summarily considered within the adapted PIESTEC framework as follows:

8.4.1. Political circumstance

Typically, farmers in Rajasthan have barely 2-3 acres of holdings each (Except for western Rajasthan). The small and marginal farmers can hardly be expected to invest in better farming technologies, nor aggregate adequate volumes of commodities as to develop alternate marketing channels away from typical APMC or multiple-trader led channel in vogue. There is, therefore, need for aggregation of such farmers into FPOs / FPCs. Typically, such FPOs / FPCs may have a combined holding of 1000-1500 acres.

8.4.2. Institutional context

Most processors currently procure from mandi. If FPCs are formed, this will open way for FPC signing MoU on behalf of member farmers for supplying directly to large processors like Cargil to earn higher revenue.

8.4.3. Economics

The prices of Bajra do not vary much in off season and hence not much suitable for higher earning avenues through future trading. However, Bajra crop has high significance in terms of its fodder value as most farmers require fodder for their cattle and in case of non-availability of in-house fodder, they have to purchase the same. Hence the opportunity cost of fodder may also be calculated while calculating earnings from Bajra. Bajra shows a decent earning potential of Rs 9820 per hectare. The fodder value could be somewhere around Rs 10800 per hectare.

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8.4.4. Social

Typically, the small and marginal farmers in Rajasthan go in for bajra as it is low input, low water and high output crop. Bajra is also considered the poor mans' food. Bajra consumption has apparently a range of health benefits by way of regulation of blood sugar and reducing cholesterol levels in blood. Bajra is a low water intensive crop and hence very good for the society. Market prices of bajra does not fluctuate steeply.

8.4.5. Technology

The yield of bajra in RACP clusters and particularly in the value chain clusters is already around double the productivity of the state and much higher than that of national productivity. However, most of the seeds available in the market are being produced in Rabi season in Southern India. Rajasthan being the largest producer of Bajra should be able to propagate commercial varieties of seeds and FPCs can play a major part in seed production and propagation by taking Foundation seeds from Universities and growing the seeds with the member farmers. The use of bajra has also started though to a limited extent in Malting industry and much innovation is needed for enhancing the use of bajra in malting.

8.4.6. Environment

The scope for promoting bajra in Kharif is an environmental friendly option. This is because the water-use irrigation footprint is far lower. The crop can sustain with barely 2-3 rainfall and additional irrigation is required only in case of draught. The crop also produces more than three times the weight of grain as fodder crop and hence is a great asset crop for farmers in Rajasthan.

8.4.7. Competition

Bajra can only be used for food and feed in winters as it has high phenol content which generates heat. Hence it is not suitable to use bajra either for human consumption or in animal feed as a major cereal grain. Hence, bajra has direct competition with wheat and rice in terms of its use as a cereal crop as food grain. Bajra flour also has lower shelf life (almost half) as compared to wheat flour due to the presence of phenolic compounds and hence bajra flour should be consumed within three months from the date of packaging.

8.5. Impact of GST over Bajra value chain:

The Goods and Services Tax is one indirect tax for the whole nation. GST is a single tax on the supply of goods and services, right from the manufacturer to the consumer. It will be levied at every stage of the product distribution chain by giving the benefit of Input Tax Credit (ITC) of the tax remitted in the previous stages. Therefore, the final consumer will bear only the GST charged by the last dealer in the supply chain, with set-off benefits at all previous stages. GST will replace all Central level taxes such as excise, service tax, custom duty as well as state level taxes like VAT, CST, entertainment tax among others.

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Table 25: Tax Structure

Transaction	New Regime	Old Regime	Remarks
Sale within the state	CGST+SGST	VAT+ Central Excise/Service tax	Revenue will be shared equally between the Centre and the State
Sale to another state	IGST	Central Sales Tax + Excise/Service Tax	There will only be one type of tax (central) in case of inter-state sales. The Center will then share the IGST revenue based on the destination of goods.

The impact on the Food Processing Businesses:

- With the latest information suggesting that the minimum GST rates will be 18% on all products.
- Implementation of the GST is said to increase the prices of agricultural goods. However, the products will be able to reach the consumer faster due to state-level taxes such as Octroi and entry taxes which will significantly reduce the time and hassle of transporting goods across state borders.
- GST will also favour the National Agricultural Market on merging all the different taxation on agricultural goods will improve the marketing and virtual market growth.
- Because GST is a consumption tax, it will be levied only when food products are sold by the manufacturer and not when they are manufactured.
- The Confederation of Indian Industries (CII) has also in its representation called for a zero rate tax on products which have a rate of up to Rs. 10/- and Rs. 20/-. It also demanded that all packaged material used as inputs by the food processing industry should have a zero-percent rate.

Impact on Restaurants and Food Joints:
Service tax liability with the credit of input VAT on goods consumed will get submerged into GST and irrespective of goods and services, the credit of input will be available for adjustment against the output liability. This will further optimize the working capital of these restaurants and consumers can expect the superior quality of goods and services.

Please refer to Annexure 4 for product wise GST rates of Food Products.

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Chapter 9- Proposed Intervention and Investments

9.1. Intervention areas for Value chain strengthening

The intervention plan of Bajra may be broadly considered in the context of activities and stakeholders as follows.

S.No	Stake holder	Roles and responsibilities	Pre-intervention constraints	Post intervention action	Action By	Timeline
1	**Farmer**	• Land Preparation • Cultivation of crops • Harvesting of crops • Sell the raw produce	• Farmers do not follow recommended PoP • Seed rate is higher upto 5 kg/ha(than recommended 3.5 to 4 kg/ha)	• Awareness campaigns for motivating farmers to use recommended PoP on soil testing, land preparation, line sowing, INM, IPM and seed rate • Crop demonstrations for use of seeds developed by research institutions	RACP in partnership with ATC and local NGO	On going process during the project period.
			• Exorbitant cost of hybrid seeds promoted by private brands (Upto 20 times the cost of bajra grain) • High cost of insecticides • Non availablity of nutrient manageme	• Facilitating formation of FPC • Pooled purchase of agri inputs through FPC at bulk price and onward sale to member farmers at wholesale price keeping minimum operating margins • Tieup of FPC with ATC for multiplication of foundation seed produced by research	• RACP, ABPF, NGO for FPC formation and further operation. • RACP to tieup with ATC for supportin g technolog y transfer of seed multiplicat	**3 months** for FPC formation, share collection and issue of business licenses

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S.No	Stake holder	Roles and responsibilities	Pre-intervention constraints	Post intervention action	Action By	Timeline
			nt solutions at right time/ High cost of transportation as farmer takes in loose quantity	institutions through member farmers of FPC and onward sale of improved variety seed at a lower cost	ion through FPC members	
			• High moisture content of harvested crop • Chances of fungal infection during sun drying on open field • Chances of contamination with foreign materials viz. dust, other seeds	• Subsidized distribution of tarpaulin sheets • Promotion of solar dryers/ community drying platforms	RACP to provision for the same and facilitate distribution to FPC members with support from local NGO	**3 months** from formation of FPC
			High dirt content /foreign material in harvested bajra (Usually resulting in 10% lower income arrival to farmer)	Ensure availability of community cleaning & Grading facility to farmers through FCSC established and maintained by FPC	RACP, SPs with input from ABPF team	**6 months** from formation of FPC
			Lack of market information related to price	Price discovery through NCDEX, eNAM.	ABPF, FPC	Subsequent cropping season after formation of FPC
			Farmers resort to immediate sale due to immediate requirement of cash	Pledge financing through FPC/FCSC, Spot/future trading through e-platforms	ABPF, FPC	Subsequent cropping season after formation of FPC

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S.No	Stake holder	Roles and responsibilities	Pre-intervention constraints	Post intervention action	Action By	Timeline
			During bumper harvest, prices collapse and hence storage option could help and distress sale.	Storage facility for farmers as part of FCSC	RACP, SPs with input from ABPF team	Subsequent cropping season after formation of FPC
2	Processors	• Process the raw produce • Value addition • Packaging of value added product	Limited adoption of direct procurement and contract farming Limited processed product available in the market which limits the marketing potential of the commodity Many existing processors and budding entrepreneurs are not aware of schemes of the GoI Including CLCSS, cluster Development scheme or "Sampada" for technology upgrading.	Setting up alternate channel to sell directly from PC to processor or large retail shops.	Large Processor/ Buyer and ABPF, RACP, FPC, RSAMB	Subsequent cropping season after formation or **6 months** whichever is earlier
				Awareness seminars for processors	ABPF, RACP, FPC	
				Policy conference, investors meet	ABPF	As required and as per schedule of RACP
3	NGOs	• Extension services to farmers • Disseminate RACP Schemes to the farm level • Distribution of seeds and farm kits as per various	• Lack of skilled personnel • Poor field-farm level coordination • Outdated extension activities • Lower level	• Training of NGO field staff on market led extension services • Business planning training • Monthly/Fortnightly review meetings with RACP • Feedback of	RACP/ ABPF	Within **3 months** from formation of FPC

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S.No	Stake holder	Roles and responsibilities	Pre-intervention constraints	Post intervention action	Action By	Timeline
		schemes • Hand holding support to the farmers regarding	of interaction and adoption of RACP/govt. schemes	farmers from service area • Exposure visits of NGO staff to successful FPCs		
4	RACP	• Establish the feasibility of sustainably increasing agricultural productivity and farmer income • Integrate agriculture water management and agricultural technology, • Establish farmer organizations (FPCs) and market innovations in selected locations	• Lack of clarity on the form of FPO-Cooperative or FPC among field staff • Selections of capable leaders for the proposed FPO • Low level of awareness among the PMU staff and farmers regarding the concept of FPC • Poor or no Market linkages of the value chain crops in clusters • Lack of active NGO staff deployed in the cluster	• Create basic understanding among the RACP PMU staff about concepts of FPC • Clear understanding on fundamental differences between FPC & Cooperative • Create market linkages by bringing more big players and processors to the cluster • Conduct training of the potential farmer leaders about FPC and its functioning • Capacity building training of the NGO staff regarding the extension services to be provided to the farmers	• ABPF • RACP PMU Line staff • NGO	Within the lifetime of the project as on-going process

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Following would be the roles and responsibility of various stake holders in the value chain. In the production stage, RACP will facilitate partnership with nearby ATC for technology demonstrations, seed propagation, training of farmers on improved PoP and technology transfer for multiplication of foundation seeds through FPC members. RACP would facilitate financing for FPC formation, ABPF to facilitate with policy and process guidelines for FPC formation and establishing FCSC, local NGO to mobilize farmer members and facilitate collection of member equity and help in initial running of FPC. The high price of privately labelled seeds for Hybrid variety of bajra is a critical constraint experienced by farmers. The cost of hybrid seed is almost 20 times that of the grain cost. In this context, a seed production programme needs to be launched availing the services of local or nearby ATC. FPC would take up bulk purchase of agri inputs at distributor price and sell member farmers at wholesale price.

At the post-harvest stage constraints in terms of high moisture content, non-availability of sufficient storage facility, high level of dirt and impurities in harvested grain which may be addressed in two phases. At farm gate, RACP may facilitate demonstration cum subsidized availability of community defying platforms/ tarpaulin sheets. As a next step, FPC may facilitate custom use of sorting/grading facility in FCSC to member farmers.

Many farmers resort to immediate sale after harvesting due to requirement of cash. FPC can offer farmers pledge financing facility through which they can get 70-80% payment immediately and leverage future market price.

The FPCs formed would need mentoring, hand holding and business planning support. This would be provided by ABPF with support from local NGO and RACP from time to time. ABPF would organize various campaigns like buyer seller meets and FPC/FCSC members training to achieve this objective. ABPF would also provide establishment guidance for FCSC as per guidelines issued by RACP.

Many procuring agencies would like to purchase directly from FPC if they become confident of quality and quantity of produce. ABPF would identify such agencies and facilitate an interface with the FPCs and help establish initial procedures.

There is also need for awareness seminars and b2b meets amongst processors and producers on the options for Special Licence and to source directly from producers (effectively aggregated into FPOs/ FPCs). Scope for re-orientation of Agri- marketing policy with reduced mandi taxes on direct procurement; and related capacity building interventions for farmers is a necessity that may be facilitated by the ABPF. The roles and responsibilities of the FPC has been discussed in 9.2.2.

9.2. Proposed Post Intervention Value Chain Map of Bajra

The restructured value chain will have FPCs and their FCSCs replacing Mandi's and undertaking aggregation plus grading and sorting and packaging services. The FPCs will work on input facilitation, custom hiring and marketing of produce. In the post intervention value chain, a third channel may be developed by targeting value-added products of bajra and promoting their increased usage among general public through awareness campaigns.

The FPCs could undertake a gamut of activities ranging from input facilitation (seeds, pesticides, fertilisers), custom hiring in addition to providing common facility storage and primary processing facilities. These could help in increasing net value accruals to farmers by 15-30%.

Seed availability though not a major issue is largely controlled by private players like Pioneer, JK, Proagro seeds whose MRP is around INR 460/1.5 kg. There are also many local players doing third party production of bajra seeds from Hyderabad area and selling at the price of branded seeds with around 50% margin structure for the dealership network. In this context, a seed production programme may be launched availing the services of Raj seeds for few FPCs. At the post-harvest stage constraints in terms of high moisture content, storage facility, high level of dirt and impurities in the harvested crop. Well-designed FCSCs could help address these vices issues at the farm/producer level. At the processing stage, gaps are most apparent, in terms of awareness

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amongst processors and inadequate producer processor links etc. These may be reduced through information dissemination

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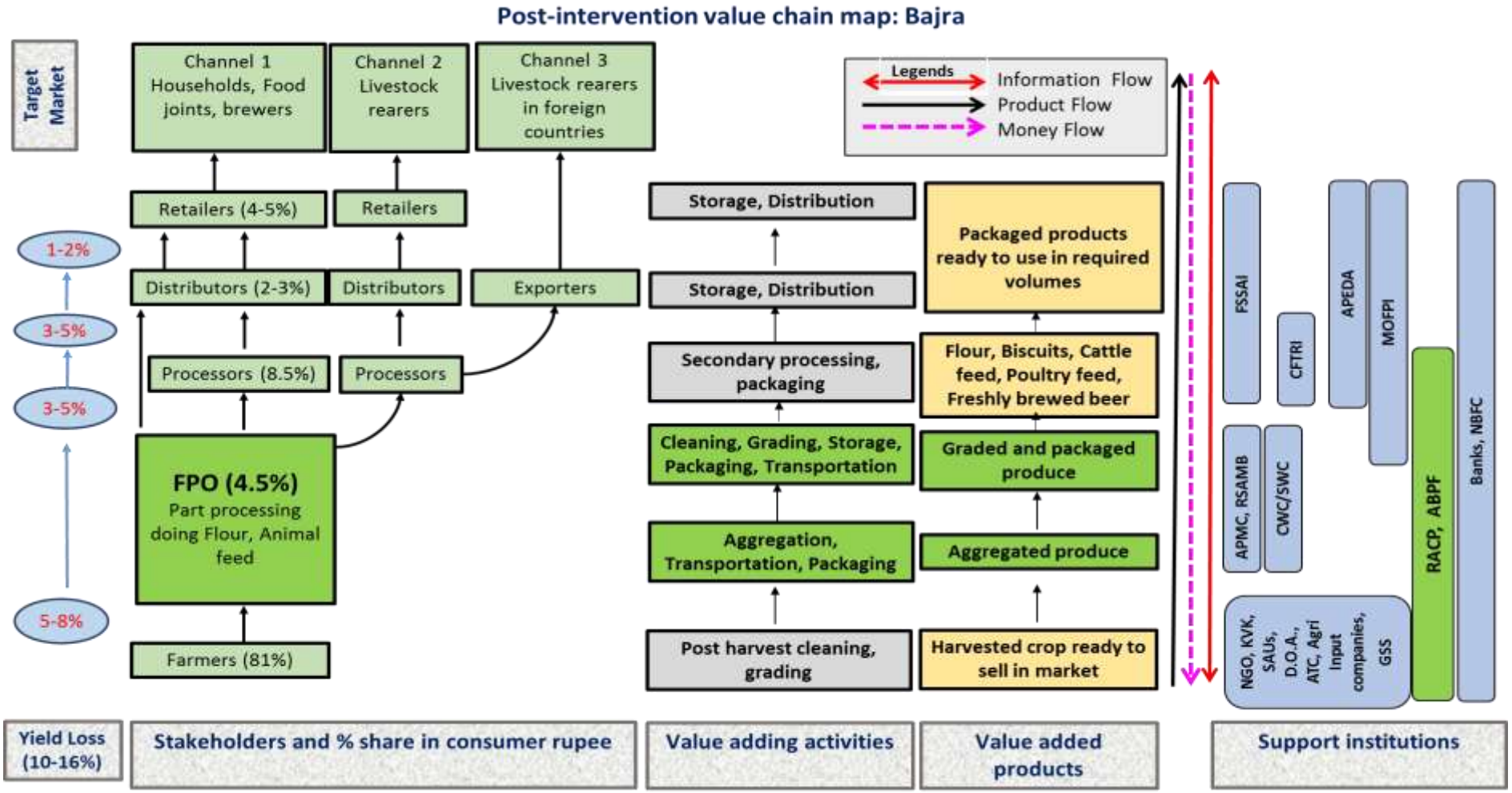
Figure 11: Proposed post-harvest value chain of Bajra



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and B2B initiatives matched with policy incentives (like mandi tax exemption) to facilitate the same. may be addressed through inputs in start-up for related enterprises/links with large players like Cargill etc. Dissemination of benefits of direct Purchase licence and apt contract farming modes are other related interventions. A reference business model for Bajra for FPC is attached in Annexure-4.

In the post intervention value chain, the post harvest loss is also supposed to be reduced to at least by 2% as farmers will sell the stock directly to FPC where there will be lesser wastage due to scientific weighing and handling. Similarly, the FPC will capture the 4.5% share of consumer rupee that was already being enjoyed by the village level and APMC trader and on expenses for transport to the APMC. This earning of FPC is an indirect income for the member farmers and their share can thus be increased from existing 81 to 84.5%. The cost of cultivation would also reduce by another 4-5% due to bulk procurement of agri input by FPC.

9.2.1. Post-harvest losses and measures to be taken:

Table 26: Yield loss and interventions for Value chain of Bajra

Stage of value chain	Yield loss (in %)	Reason	Intervention
Pre-harvest stage during crop maturity	2-3	• Bird invasion • Rodents	• Use of T Guards • Use of rodent control measures
Post-harvest handling at farm gate	3-5	• Lack of mechanized harvesting • Broken, immature, shrivelled grains • Contamination during drying • Lack of appropriate storage structure on farm	• Training on good harvesting practices including mechanized harvesting, drying of crop using tarpaulin sheets or clean floor
Loss during local transportation to Mandi and handling	1	• Pilferage • Local handling • Sampling	• Proper packaging of harvested material
Purchase by Trader/ Processor	2-3	• Poor storage structure and inefficient handling of harvested produce • Loss during transportation due to loose packaging and poor handling	• Centralized aggregation from farmers at CFC of FPC • Packaging unit under CFC
Processing	3-5	• Use low end and obsolete technologies • Mismatch of capacities of various machine lines	• Set up primary processing units for FPC • Support and guide agri-entrepreneurs for setting up modern and high end machines
Distribution to wholesalers/retailers	1-2	• Poor handling of value added product • Inefficient packaging of product • Improper storage facility • Lower shelf life of product	• Support in storage facility through govt. warehouses • Efficient packaging of produce to prevent leakage and improve shelf life
Overall estimated loss	**14-18**		

9.2.2. Intervention through FPC Model in Bajra value chain:

Aggregation is the proposed solution of the constraints farmers are facing at present. It is proposed to form Farmers Producers' Company by bringing farmers together in the form of voluntary groups of about 15 to 20 active farmers and federating 20 to 25 such groups into a Producer Company. These Producer Companies will be functioning on behalf of member farmers and will strive to undertake a range of activities which will result in added value accruals to farmers and value to

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farmers produce. To form a producer company, producer groups will be mobilized (in some cases, this initiative may have already been completed by NGO's).

It is envisaged that an elected committee of members of Producers Groups will form a management committee and oversee the performance of an incentivized manager/CEO. The manager will be trained in technical issues of post-harvest management, marketing and in operating a transparent accounting system. The ABPF will support the operation of the Producer Company, and accelerate the cross learning of best practices.

FPC Development Approach

The FPC development approach may be viewed as depicted below:

Figure 12: FPC development approach

Following are the steps to be followed for formation of the FPC:

- PRI of the MTG: The MTGs will be made aware on the FPC model through PRI and individual farmers will be motivated to join the FPC as shareholder through respective MTGs.
- Initial discussions with MTG leaders: After PRI is done, initial discussion will be done with the MTG leaders for further orientation on FPC concept.
- Identification of MTG leaders: MTG leaders who show inclination to the concept will be selected in the executive committee for FPC formation.
- Resource mobilization and FPC planning: The executive committee will meet 2-3 times to plan further activities of FPC viz. crops, strategy for business etc.

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- Election of BoD and Share collection: 10-12 BoD will be identified along with 2-3 expert directors one each from Agri, Horti, AH and WS dept. The BoD will decide on share value and initiate collection of share through MTG leaders.
- FPC registration: Following identification of FPC BoD, registration will be done. This may take 1-2 months as DIN no of BoD has to be generated first. Care should be take that all elected BoD should have PAN no so that there is no delay in paper formalities for registrations.
- FPC business: Following registration of FPC, ABPF will prepare business plan for the FPC and facilitate market linkage for input and output.
- Setup of processing/ financing – ABPF will further facilitate establishment of processing unit setup along with feasibility studies and planning business linkage with market players.

Policy and Management

A FPC will function within the overall policy and regulatory framework as per the Producer Company Act. The management of a FPC will vest with the elected Board from amongst the members. The provision about constitution of managing committee will be made in the byelaws. The management of FPCs will be by an elected Board of Directors. Therefore, the representatives of farmers will actually oversee and manage the affairs of a FPC.

The selection criteria for membership of FPC may be viewed as follows:

1. A member will express his willingness to become a member of MTG.
2. A member will actively participate in all functions and activities of MTG
3. A member will contribute his equity to the FPC
4. A member will bring all or part of his produce to the FPC for sale.
5. A member will purchase all or part of his farm inputs through the FPC.
6. A member will produce and prepare his produce for marketing as per directions of FPC.
7. A member will contribute his share to the Producer Association as upfront payment for the business development plan of a FPC as needed.
8. A member will contribute his share to the Producer Company towards the reserves of FPC as needed.

Illustrative list of components of a common facility of a Producer Company (Food Grain)

- Godown for storage, drying platforms
- 2-3 MT per hour grain cleaning, grading, and packing machinery with shed
- Additional need based Agricultural Equipment
- Computer with internet connectivity for market information
- Display Board with Accessories
- Auction Hall
- Input Suppliers Shops
- Toilets
- Drinking water & Electricity

Note: Though the illustrative infrastructure proposed is shown in the above tables, the actual infrastructure to be developed will be need based and on participative consultation process.

Typically, start-up may be involved in secondary and tertiary processing activities while FPO's may be involved in post-harvest and primary processing activity. In many cases, start-up may emerge firm within FPO members.

The evaluation of success should be evaluated on the parameters as under:

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I. PCs operating without financial support by the end of 36 months.
II. The PC operates with a reserve fund to cover short term cash flow deficit and with potential for reinvestment in various activities
III. The PC has an effective governing structure
IV. The PC has a transparent accounting system
V. The PC can function as a working example for other farmer organizations to observe and learn from
VI. Contribution towards increasing farmers'/members incomes

FPC Revenue model

The revenue model for typical FPCs may be viewed in terms of revenue from:

1. Input facilitation services (this could imply revenue by virtue of service such as dealership/distributorship for seeds, pesticides or fertilizers). About 50% of the dealer's discount may be perhaps is retained by FPC and 50 % be passed on to FPC farmer member as to reduce their input costs.
2. Processing and storage services through FCSCs to be offered to FPC members and other providers in the region and user/service change collected (typically) at perhaps the rate of 1 to 3 percent of value of commodity.
3. Marketing service may be offered in terms of facilitating charges typically @ between 1-2 percent of sales value.
4. MSP facilitation service in terms of facilitating procurement and supply to NAFED/SFAC etc. after, a 1 percent service charges is levied for such activity by FPOs.
5. NCDEX related farmers trading may be facilited b FPOs as a risk hedging option and user charges collected at a negotiated rate with members.
6. Custom hiring services may be provided either through tying up with service providers or including equipment as part of FCSC.

Working capital service in terms of FPC providing and marketing of produce from member farmers. Here, the FPC may retain the price spread as service charge.

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9.3. Conclusion:

Bajra has been a major crop of economic significance for farmers in semi-arid areas of Rajasthan due to low water requirement, production of grain and fodder both. The productivity in RACP clusters has already been above the state and national average. However, some major constraints in production stage are in-consistent weather pattern, high cost of seeds and farmers not following PoP. The crop suffers around 15-18% post-harvest loss due to handling at various stages in the value chain. There is currently scope of further reducing the cost of cultivation through reducing the cost of seeds and improved productivity through good agriculture practices. The post-harvest losses also need to be reduced through proper education of farmers and other handlers in the value chain. Currently, the farmers' share in the consumer rupee is on higher side as there is little value addition activity in the bajra value chain for human consumption apart from being used as animal feed. As the value addition activities in bajra value chain enhance, the share of farmers would also reduce as demonstrated in other value chain. FPC of farmers would be an ideal intervention for evolving the role of farmers from being chain actors to chain partners by doing both backward and forward integration of activities related to Bajra value chain. At the back end, the FPC would help in reducing cost of cultivation by undertaking bulk purchase of agri input at wholesale price and selling farmers at a price equal to or lower than the retail price. Similarly, in the front end of the value chain, the FPC would undertake direct collection of Bajra from the farmers and thereby reduce both the wastage and cost of visit to mandi for farmers. The FPC can further undertake primary/secondary processing of the grain and supply directly to large processors and other value chain actors.

For this, a strong base has to be facilitated for the FPC by motivating farmers to contribute in terms of equity and business participation with the FPC. The Board and FPC staff has also to be handholded for a period of 2-3 years to train them on all processes of FPC management and business processes.

All stake holders including RACP, NGO, ABPF, Bankers and other support institutions therefore need to work cohesively towards the common goal of facilitating a strong community organization which can run in a sustainable manner after the project period.

Proposed outcome:

- 4% direct benefit on price through FPC and 2% benefit due to high price received directly
- 1% saving on cost of transportation to APMC and associated charges
- Increased competition in input and output market resulting in higher earning potential for farmer
- Increased bargaining power of farmers
- Sustainable operations through community institution and assets through FPC and FCSC
- More water available for other crop or for increase in area

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References

1. 2016 (http://millets.res.in/m_recipes/Nutional_health_benefits.pdf) (retrieved on April 13,2017)
2. [1] http://ejournal.icrisat.org/Volume8/IMPI/Availability_and_utilization.pdf (retrieved on April 13,2017)
3. [1] http://millets.res.in/m_recipes/Nutional_health_benefits.pdf (retrieved on April 13,2017)
4. [1] http://www.cgiar.org/our-strategy/crop-factsheets/millets/ (retrieved on April 14,2017)
5. [1] http://www.aicpmip.res.in/pcr2015.pdf (retrieved on April 13,2017)
6. [1] http://eands.dacnet.nic.in/PDF/Agricultural-Statistics-At-Glance2014.pdf (retrieved on April 14,2017)
7. [1]http://krishijagran.com/farm/scenario-in-india/2014/12/All-India-Area-production-and-yield-statuscrops-during-
8. [1]The Hindu Business October 4,2010 (http://www.thehindubusinessline.com/todays-paper/tp-agri-biz-and-commodity/well-adapted-to-production-systems/article1005709.ece)
9. [1] http://www.icar.org.in/files/state-specific/chapter/104.htm
10. [1] http://www.icar.org.in/files/state-specific/chapter/104.htm (retrieved on April14,2017)
11. [1] http://pib.nic.in/newsite/mbErel.aspx?relid=106818
12. [1] 4/13/2017 Bajra Cultivation Information (Bajra) Guide (http://www.agrifarming.in/bajracultivation/)
13. [1] oar.icrisat.org/105/4/IcrisatPolicyBrief15Flyer.pdf
14. [1] http://hope.icrisat.org/wp-content/uploads/2013/10/Market-oppotuiinity-for-pearl-millet-in-NW-India1.pdf
15. Acknowledging inputs from RACP officials, related producers, processors, industry associations,NGOs, ATMA, Dept of Agriculture and Dr. Harish Verma and Dr. Arjun Verma, KVK Jhalawar.

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Annexure 1: Stakeholder's consulted over the study

Farmers:

- 5 Farmers in Bansur cluster
- 5 Farmers in Mokhampura Cluster
- 5 Famer in Bari cluster
- 5 Farmers in Bundi cluster
- 5 Farmers in Kushalgarh cluster

Processors:

1. Cargill, Mr. Sandeep Mishra, Punjab, 9987943174
2. Godrej Agrovet, Mr. Ranjeewan Sharma, Punjab
3. Urmidwar Animal Feeds, Manoj Dixit, Jaipur, 9413014527
4. Nyasa Organic, Viren Garg,, Jaipur, 9829097616
5. Sunrise Natural , Prashant Chaturvedi, Jaipur , 7533006573
6. Vijay Store, Jagmohan Vijay, Jaipur, 9829033111
7. Rajasthan Agro Products, Manoharlal Gupta, Jaipur, 8039635559
8. Apex International, Jaipur, 8079452300
9. Jiya Agro PVT. LTD, 8071744288, New Delhi

Traders:

1. Sethia Associates ,Vinod Sethia, APMC Bundi, 08162801776
2. Satguru Inductries, Naresh kumar ,9928341932
3. Moolchand Nemichand Jain, APMC, Tonk, 9414656842
4. Susheel Kumar Shanti lal Jain, APMC, Tonk, 9414029027
5. Gaurav and associates, Kukerkheda Mandi, Jaipur, 8764025507

Government agencies:

1. Mr Shekhawat, DPM, RACP, Jaipur, 9929606427
2. Mr Sunil Chaudhary DPM, RACP (DDA Extn) Bundi, 9414676992
3. Mr Ramesh kumar Bharti District Cordinator (Agriculture) 9950661459
4. T R Meena , (Secretary), APMC Bundi, 9414359097
5. Dr Rakesh Kumar (SMS), KVK Bundi, 9413093805
6. Dr N.L Meena (Programme coordinator), KVK Bundi, 9414539008

Others:

1. Mr Shabbir Mishra ,Team Leader, NGO, Bundi, 8309399781
2. Bhawarsingh Ahada (Director), FPO Alod, 9929805295
3. Ramesh Sharma, Agril Supervisor, Sattur(Gudha), 9950043688
4. Mr Dilip Gupta, State Head Indian Gramin Services 09414051489

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Annexure 2: List of Central Warehousing Corporation (CWCs) in Rajasthan

Warehouse	Project Description	Manager	Phone	Capacity
BHIWADI	C/o Jaquar & Company Pvt. Ltd., SP-496, RIICO Inld Area, Bhiwadi – 301019	A. C. Yadav	01493 297825	4356
ALWAR	A-315, NSC, Oppt. ED, Paryware Pvt. Ltd. Co. Alwar	R. N. Meena	0144 23721	3574
BARAN	Spl. No. 01 ,RIICO Indl Area, Baran Road, Baran	V. K. Jaiswal	9460079493	5000
BHARATPUR	Plot No. G-162 to 165 & F-166 to 171, Brij Ind. Area, Behind Nafed Plant, Phase-II, Hathni Road, Bharatpur	Devendra Prakash	05644-228654	9674
BIKANER	Behind Sabzi Mandi, Pugal Road, Unit-I, Bikaner	Prit Pal	0151 2212399	25400
BIKANER-II	Opposite Govt. Engineering College, Karni Indutrial Area, Ph.II Bikaner-334004	R. D. Punia	0151 211003	5000
SRIGANGANGR-I	Near Power House Sriganganaga-335001	S.S. Brar	0154 2440107	25200
SRIGANGANGR-II	Udyog Vihar Plot No. E-194 to202 Sriganganaga-335001	N.K. Chabra	0154 2494403	10000
KESARISINGHPUR	C/o ARDC Godown,Mizewali Road,Kesrisinghpur Distt.Srigangar	Dhanwat Singh	01501-233710	10176
HANUMANGARH TOWN	C/o FCI, Opp. Railway Station, Hanumangarh Town	K. D. Dhiman, FCI		13262
HANUMANGARH-I	Sector - 8, New Mandi, Hanumangarh Junction, Hanumangarh	J. R. Sharma	01552 260602	21200
HANUMANGARH-II	RICCO Phase-II , Opposite RICCO, Water Works, Hanumangarh	Bhart Bhushan	01552 211794	15000
TIBBI	10, GGR, Hanumangarh Road, Tibbi, Distt. Hanumangarh	Anupam Kumar	01539 224111	1000
SITAPURA-I	Plot No.SPL-1296,EPIP Sitapura, Ind. Area, Jaipur-302002	S.K. Sharma	0141 2771710 , 2770227	14870

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Warehouse	Project Description	Manager	Phone	Capacity
SITAPURA-II	Plot No.SP-1,RIICO Industrial Area,Sitapura, Jaipur	Y.K. Dubey	0141 2770223	11729
KOTPUTLI	Near Cement Factory,Vill.-Ramsinghpura Gopalpura Road,Kotputll, Distt. Jaipur.	Desh Raj	01421 215112 97	5000
JHUNJHUNU	Plot No. SP-287 RICCO Industrial Area,	Raghunath Singh	01592 250138	5000
SURAJGARH	Bhuana Road, Surajgarh-333029	Rampal Singh	01596 2238349	2868
KOTA I	Ind. Area DCM Road, Nr New Grain Market Kota-324007	S N Meena 0744 2363638		36830
KOTA II	Indraprasth md. Area, Road,No. 1, Near Daknia Railway Station Kota-324005	S.S.Meena	0744 2438019	49300
KOTA III	Plot No. SP-1, Kuber Ind. Area, Ranpur, Kota III	S N Panchal		25000
RAMGANJ MANDI	Khairabad Road, Ramganj Mandil Distt.-Kota	OP Mudgil	07459 22264	9893
NAGAUR	Nr. All India Radio Basni Road, Nagaur- 341001	R.S. Mathur	01582 241002	7401
PARABATSAR	C/o ARDC Godown, Near Old Rly. Station.Parbatsar, Distt. Nagaur	Ram Behari	9460462881	28093
SIKAR	Jagmalpura, Via-Katrathal, Post-Bhadwasi ,Sikar-33200 1	Nand Lal Verma	01572 272013	5000
SRIMADHOPUR	Hanspur Road, Srimadhopur-332715	Kishore Prasad	01575 251699	20600
DEOLI	C/o Juptier Metal Pvt. Ltd., NH—12, Deoli Distt : Tonk 01434 239249	Kailash Narayan	01434-239249	5000
FATEHNAGAR	MOR Mills Product, Plot No. H-49 Road No.2, RICCO Indl Area, Fatehnagar-313205	V. P. Singh	02955-220411	3106
Central Warehouse	Opposite Krishna Dharma Kanta, Udaipur by Pass. Beawar, Distt. Ajmer	Raj Raj Kumar Sharma		14849
Central Warehouse	Katori Wala Tibara, Near Water Works, Tizara Road, Alwar	Rajendra Prasad	1442731026	8133
Central Warehouse	Village MOR ,Kushalgarh Distt.Banswara.	D.C. singh	2965274517	3400
Central Warehouse	Plot No.G-162 to 165,F-166 to 171, Behind NAFED Plant, Phase-II, Brij Industrial Area, Hahteni Road, Bharatpur-321301	N. S. Meena	5644228654	9674

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Annexure 3: List of State Warehousing Corporation (SWCs) in Rajasthan

S. No	District	Name of Warehouse	Warehousing Capacity			Utilization including Reservation	Percentage Utilization
			Own Constt.	Other than own Constt.	Total		
1	**Ajmer**	1. Ajmer	13350	0	13350	13733	103
		2. Beawar	6300	0	6300	5086	81
		3. Kekri	3500	0	3500	3704	106
		4. Kishangarh	5400	0	5400	4141	77
2	**Alwar**	5. Alwar	22650	0	22650	18967	84
		6. Khairthal	7400	0	7400	3265	44
3	**Banswara**	7. Banswara	12200	0	12200	7608	62
4	**Baran**	8. Baran	27520	0	27520	15344	56
		9. Antah	9200	0	9200	7472	81
		10. Atru	5400	0	5400	1767	33
		11. Chhabra	11550	0	11550	2079	18
		12. Siswali	6750	0	6750	5304	79
5	**Barmer**	13. Barmer	6840	0	6840	7533	110
		14. Balotra	3600	0	3600	2463	68
6	**Bharatpur**	15. Bharatpur	22000	0	22000	19499	89
		16. Bayana	4700	0	4700	3995	85
		17. Nadbai	6950	0	6950	4722	68
7	**Bhilwara**	18. Bhilwara	6750	8950	15700	16366	104
		19. Gulabpura	7550	2000	9550	9505	100
		20. Mandalgarh	3600	0	3600	1497	42
8	**Bikaner**	21. Khajuwala	10800	0	10800	8694	81
		22. Kolayat	4050	0	4050	0	0
		23. Nokha	2700	8900	11600	12460	107
		24. Loonkarasar	5400	0	5400	1510	28

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S. No	District	Name of Warehouse	Warehousing Capacity			Utilization including Reservation	Percentage Utilization
			Own Constt.	Other than own Constt.	Total		
9	**Bundi**	25. Bundi	24620	0	24620	18536	75
		26. Kapren	6750	0	6750	6523	97
		27.Keshoraipatan	6000	0	6000	1161	19
10	**Chittorgarh**	28. Chittorgarh	17250	0	17250	17656	102
		29. Nimbahera	13500	0	13500	13095	97
11	**Churu**		0	0	0	0	0
12	**Dausa**	30. Dausa	12900	0	12900	2521	20
		31. Bandikui	13680	0	13680	6031	44
		32. Lalsot	1260	1620	2880	1218	42

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Annexure: 4 Product wise GST rates of Food Products

PRODUCT WISE GST RATES as on 10.11.2017 (Latest Revision)

- **GST-28%**
  1. Molasses
  2. Pan Masala
  3. All goods [including aerated waters] containing added sugar or other sweetening matter or flavoured
- **GST-18%**
  1. Malt, whether or not roasted
  2. Sugar confectionery
  3. All preparations of cereals, flour, starch or milk for infant use and sold retail
  4. Corn flakes and other cereal flakes
  5. Waffles and wafers (other than chocolate coating)
  6. Pastries and cakes
  7. Extracts, essences and concentrates of tea or mate
  8. Soups and broths
  9. Ice cream and other edible ice
  10. Instant food mixes, soft drink concentrates, sharbat, betel, supari, packaged food
  11. Water, including natural or artificial mineral waters and aerated waters not sweetened
  12. Ethyl alcohol and other spirits
  13. Vinegar and substitutes
  14. Custard powder
  15. Chewing gum/bubble gum and white chocolate, not containing cocoa (17041000,17049090)
  16. Cocoa butter, fat and oil

17. Cocoa powder, not containing added sugar or sweetening matter
18. Chocolates and other food preparations containing cocoa
19. Malt extract (other than for infant use and mixes and doughs of bakers)
20. Waffles and wafers coated with or containing chocolate
21. Extract, essences and concentrates of coffee
22. Other non-alcoholic beverages
23. Food preparations not elsewhere specified or included i.e. Protein concentrates and textured protein substances, Sugar-syrups containing added flavouring or colouring matter, not elsewhere specified or included; lactose syrup; glucose syrup; and malto dextrin syrup, Compound preparations for making not alcoholic beverages, Food flavouring material, Churna for pan [other than pan masala].

- **GST – 12 %**

1. All meat in unit containers put up in frozen, salted, dried, smoked state
2. All meat and marine products prepared or preserved.
3. Butter, ghee, butter oil, cheese
4. All goods under Chapter 20 (preparations of vegetables, fruits, nuts or other parts of
5. plants, including pickle, murabba, chutney, jam, jelly)
6. Ketch-up & sauces, Mustard sauces
7. Dry fruits
8. Starches
9. Animal fats and oils
10. Fruit and vegetable juices
11. Roasted chicory and coffee substitutes
12. Yeasts and prepared baking powders
13. Namkeens put up in unit container and bearing a brand name, bhujiya, mixture, chabena
14. Bari made of pulses including mungodi
15. Soya milk drinks
16. Fruit pulp or fruit juice based drinks
17. Tender coconut water (in unit container with brand name)
18. Beverages containing milk
19. Batters including Idli/Dosa batter
20. Condensed milk
21. Refined sugar, sugar cubes

22. Pasta, whether or not cooked or stuffed (with meat or other substances) or otherwise prepared, such as spaghetti, macaroni, noodles, lasagna, gnocchi, ravioli, cannelloni; couscous, whether or not prepared
23. Curry paste, mayonnaise and salad dressing; mixed condiments and mixed seasoning
24. Diabetic foods

- **GST – 5 %**

1. All fish variants (except seeds of fish, prawn& shrimp) processed, cured, frozen state
2. Ultra-high temperature milk
3. Milk and cream including skimmed milk powder but excluding condensed milk
4. Yoghurt and other fermented milk and cream
5. Chena or paneer in unit container and branded
6. Egg yolk, fresh or dried
7. Natural honey in branded unit container
8. Vegetables frozen or preserved (but unsuitable in that state for immediate consumption)
9. Edible fruits and nuts; peel of citrus fruit or melons, in frozen or preserved state
10. Coffee, tea, pepper, vanilla, cloves, cardamoms
11. Seeds of anise, coriander, cumin
12. Ginger (other than fresh ginger), saffron, turmeric, other spices
13. Cereal groats, meal and pellets in branded unit container
14. Cereal grains worked upon (hulled, rolled, flaked)
15. Meal, powder, flakes, granules and pellets of potatoes
16. Meal and powder of the dried leguminous vegetables (pulses, sago, tamarind)
17. Wheat gluten
18. Soya beans
19. Ground nuts
20. Copra
21. Linseed, rape seeds, sunflower seeds, other oilseeds like mustard, poppy,
22. Flour and meals of oilseeds
23. Sugar beet and sugar cane (frozen and dried)
24. Vegetable fats and oils (groundnut, olive, palm, sunflower oil etc)
25. Beet sugar, cane sugar, khandsari sugar
26. Cocoa beans, shells and paste
27. Mixes and doughs for preparation of bread, pastry and other baker's wares
28. Pizza bread

29. Seviyan
30. Rusks, toasted bread
31. Sweetmeats
32. Flours, meals, and pellets of meat, fish meant for animal consumption
33. Cashew nuts and cashew nut in shell
34. Raisin
35. Ice and snow
36. Walnuts
37. Tamarind Dried
38. Roasted Gram
39. Oil Cakes irrespective of end use
40. Mangoes Sliced Dried
41. Khakra and Plain Chapati/roti
42. Food preparation put up in unit containers and intended for free distribution to economically weaker sections of the society under a programme duly approved by the Central Government or any State Government, subject to specified conditions.
43. Namkeens other than those put up in unit container and bearing a registered brand name or bearing a brand name on which an actionable claim or enforceable right in a court of law is available.
44. All goods under Chapter 0202/0203/0204/0205/0206/0207/0208/0209/0210/0504 [except fresh or chilled], put up in unit container and, - (a) bearing a registered brand name; or (b) bearing a brand name on which an actionable claim or enforceable right in a court of law is available [other than those where any actionable claim or enforceable right in respect of such brand name has been foregone voluntarily].
45. Desiccated Coconut
46. Flour of potatoes put up in unit container and, - (a) bearing a registered brand name; or (b) bearing a brand name on which an actionable claim or enforceable right in a court of law is available (other than those where any actionable claim or enforceable right in respect of such brand name has been foregone voluntarily).
47. Puffed Rice Chikki, Peanut Chikki, Sesame Chikki til chikki, til patti, til revdi, sugar makhana, gajak, groundnut sweats Khaja, Khajuli, Anarsa, Sakar, Khadi Sakar, harda, sakariya, gatta, kuliya, elaichidana, lukumdana.
48. Idli, Dosa Batter
49. Chutney Powder

- **GST – Nil %**

1. Meat (Other than in frozen state and put up in container)
2. Bones and horn cores, bone grist, bone meal etc., hoof meal, horn meal, etc
3. Fish, prawn and shrimp seeds

4. All fish, fresh or chilled (but not processed, cured and frozen)
5. Fresh milk, pasteurized milk but not concentrated, sweetened
6. Eggs (in shell)
7. Curd, lassi, buttermilk
8. Chena or paneer (except in unit container with brand name)
9. Natural honey (no container-no brand)
10. Fresh fruits and vegetables, roots and tubers (except in frozen state or preserved)
11. Dried fruits
12. Leguminous vegetables, shelled or unshelled
13. Dried leguminous vegetables, shelled, whether or not skinned or split (pulses)
14. Coffee beans, unprocessed tea leaves, fresh spices
15. All cereals (no container-no brand)
16. Cereal grains hulled
17. Flour
18. Atta, maida, besan (no container-no brand)
19. Wheat or meslin flour
20. Cereal flour, groats and meals (no container-no brand)
21. Flour of potato, dried leguminous vegetables (no container-no brand)
22. Oilseeds of seed quality
23. Cane jiggery (gur)
24. Palmyra jaggery
25. Puffed, flattened and parched rice
26. Pappad (except when served for consumption)
27. Bread (branded or otherwise) (except when served for consumption and pizza bread)
28. Prasadam
29. Water (other than aerated, sealed etc)
30. Non-alcoholic toddy
31. Tender coconut powder
32. Acquatic, poultry and cattle feed
33. Salt, all types
34. Cotton seed oil cake irrespective of end use
35. All goods [except fresh or chilled], other than Sl. No. 44 of GST 5% Category.
36. All goods under Chapter 0303/0304/0305/0306/0307/0308 [except fresh or chilled], other than those put up in unit container and, - (a) bearing a registered brand name; or (b) bearing

a brand name on which an actionable claim or enforceable right in a court of law is available [other than those where any actionable claim or enforceable right in respect of such brand name has been foregone voluntarily].

37. Vegetable (uncooked or cooked by steaming or boiling in water), frozen other than those put up in unit container and, (a) bearing a registered brand name; or (b) bearing a brand name on which an actionable claim or enforceable right in a court of law is available [other than those where any actionable claim or enforceable right in respect of such brand name has been foregone voluntarily].
38. Manioc, arrowroot, salep, Jerusalem artichokes, sweet potatoes and similar roots and tubers with high starch or inulin content, dried, whether or not sliced or in the form of pellets.
39. Manioc, arrowroot, salep, Jerusalem artichokes, sweet potatoes and similar roots and tubers with high starch or inulin content, frozen, other than those put up in unit container whether or not sliced or in the form of pellets. and, - (a) bearing a registered brand name; or (b) bearing a brand name on which an actionable claim or enforceable right in a court of law is available [other than those where any actionable claim or enforceable right in respect of such brand name has been foregone voluntarily].
40. Dried makhana, whether or not shelled or peeled other than those put up in unit container and, - (a) bearing a registered brand name; or (b) bearing a brand name on which an actionable claim or enforceable right in a court of law is available [other than those where any actionable claim or enforceable right in respect of such brand name has been foregone voluntarily].
41. Meals, powder, flakes, granules and pallets of potatoes other than those put up in unit container and, - (a) bearing a registered brand name; or (b) bearing a brand name on which an actionable claim or enforceable right in a court of law is available (other than those where any actionable claim or enforceable right in respect of such brand name has been foregone voluntarily).
42. Guar meal.
43. Hop cones, neither ground nor powdered nor in the form of pellets.
44. Coconut shell, un-worked.
45. Khandsari sugar

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