

# A Regional Proposal under NAFCC on



## Climate Resilience Building among Farmers through Crop Residue Management (For Punjab, Haryana, UP & Rajasthan State )

Compiled by NABARD (NIE)

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Mission

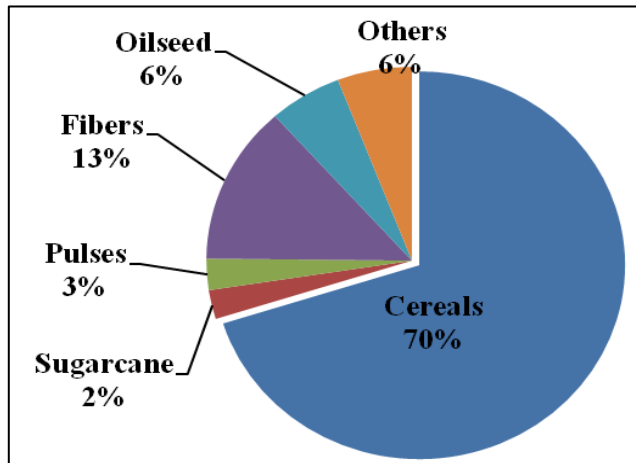
Straw is an asset, not a  
liability

Title of Project/Programme:	<b>Climate Resilience Building among Farmers through Crop Residue Management (for Punjab, Haryana &amp; Rajasthan)</b>
Project/Programme Objective/s:	<ul style="list-style-type: none"> <li>✓ To lower Green House Gases Emissions in project areas by i). creating awareness among farmers through crop residue management and by ii). Promoting alternate uses of crop residue.</li> <li>✓ To create implementable and sustainable entrepreneurship models in rural areas by engaging FCs/ FPOs /PACs/ JLGs/ Individual entrepreneurs for effective crop residue management through upscaling successful initiatives and innovative ideas.</li> <li>✓ To enhance the climate resilience and income of the farmers through alternative uses of crop residue management in project areas.</li> <li>✓ To identify the other co-benefits and suggest policy intervention.</li> </ul>
Project/ Programme Sector:	Agriculture
Name of Executing Entity/ies/Department:	<p>Multiple EEs</p> <ol style="list-style-type: none"> <li>1. Punjab – Dept. of Agri. &amp; Punjab Council for Science and Technology (PCST)</li> <li>2. Haryana – Dept of Agriculture (DoA)</li> <li>3. Rajasthan – Dept of Agriculture (DoA) &amp; AH</li> <li>4. Uttar Pradesh - Dept of Agriculture (DoA)/Bio-Energy Board</li> </ol>
Beneficiaries:	Farmers
Project Duration: Start Date: End Date:	<p>3 Years 3 months</p> <p>Start Date: 1st January 2018</p> <p>End Date: 31st March 2021</p> <p>(post completion evaluation to be completed by December 2021)</p>
Amount of Financing Requested (Rs.):	Rs. 549.38 Cr.
<u>Project Location</u> State: District:	Punjab, Haryana, Rajasthan & Uttar Pradesh

## 1.1 Project / Programme Background and Context:

### 1.1.1 Problem Context

India produces more than 500 million tons (Mt) of crop residues annually. Among different crops, cereals generate 352 Mt residue followed by fibres (66 Mt), oilseed (29 Mt), pulses (13 Mt) and sugarcane (12 Mt) (Fig. 1). The cereal crops (rice, wheat, maize, millets) contribute 70% while rice crop alone contributes 34% of crop residues. Wheat ranks second with 22% of residues whereas fibre crops contribute 13% of residues generated from all crops. Among fibres, cotton generates maximum (53 Mt) with 11% of crop residues. Coconut ranks second among fibre crops with 12 Mt of residue generation. Sugarcane residues comprising tops and leaves generates 12 Mt i.e., 2% of crop residues in India (Source; MNRE).



Generation of cereal residues is highest in Uttar Pradesh (53 Mt) followed by Punjab (44 Mt) and West Bengal (33 Mt). Maharashtra contributes maximum to the generation of residues of pulses (3 Mt) while residues from fibre crop is dominant in Andhra Pradesh (14 Mt). Gujarat and Rajasthan generate about 6 Mt each of residues from oilseed crops. Processing of agricultural produce through milling and packaging also produces substantial amount of residues. Crop residues are natural resources with tremendous value to farmers. These residues are used as animal feed, composting, thatching for rural houses and fuel for domestic and industrial use.

Various studies have brought to the forefront the quantity of crop stubble generated in India. As per different studies, the residues of rice and wheat crops are major contributors in the total stubble loads in India. One such study by Garg (2008) estimates the contribution of rice and wheat stubble loads in the total stubble as 36 and 41 %, respectively in the year 2000, while the contribution of Punjab in the total burnt stubble of rice and wheat to be 11 and 36 %, respectively during the same time period. According to Mandal et al. (2004), the total amount of crop residue generated in India is estimated at  $350 \times 10^6$  kg year<sup>-1</sup> of which wheat residue constitutes about 27 % and rice residue about 51 %. According to Gupta et al. (2004), the total crop residue produced in India during 2000 was 347 million tonnes, of which rice and wheat crop residues together constituted more than 200 million tonnes.

Production and consumption activities generate pollution and waste, and atmospheric environment can absorb pollution/waste upto a limit. Agriculture is one of the important production activities and it generates huge amount of crop residues. A large portion of the residues, about 140 million



tonnes, is burned in field primarily to clear the field from straw and stubble after the harvest of the preceding crop which generates a significant amount of air pollution. The problem is severe in irrigated agriculture, particularly in the mechanized rice-wheat system. Atmospheric environment can absorb this pollution in a particular geographic region given its assimilative capacity. If the burning activities remain confined within the assimilative capacity, the pollution does not create harmful effects. Therefore, in the initial stages when the production and burning activities are limited, pollution caused through these activities is not considered a problem. However, due to technological advancements in the agricultural sector, the extent and management of Crop Stubble waste concentration has gone beyond the assimilative capacity of the environmental limit, thereby distorting the balance.

### 1.1.2. Utilisation of Crop Residues

Traditionally crop residues have numerous competing uses such as animal feed, fodder, fuel, roof thatching, packaging and composting. Cereal residues are mainly used as cattle feed. Rice straw and husk is used as domestic fuel or in boilers for parboiling rice in states like West Bengal. The uses for various residues are different in different states. Farmers use residue either themselves or sell it to other landless households or intermediaries, who in turn sell the residues to industries. The remaining residues are left unused or burned in field.

In states like Punjab and Haryana where rice residues are not used as cattle feed, large amount rice straw is burned in field. Sugarcane tops in most of the areas is either used for feeding of dairy animals or burned in field for ratoon crop. Residues of groundnut are burned as fuel in brick kilns and lime kilns. Cotton, chilli, pulses and oilseeds residues are mainly used as fuel for household needs. Coconut shell, stalks of rapeseed and mustard, pigeon pea and jute and mesta, and sun flower are used as domestic fuel. Coconut generates about 3 Mt of husk annually and about 1.2 Mt is utilized for making coir and 1 Mt burned as fuel.

### 1.1.3. Statewise Generation of Crop Residue

Estimated total crop residue surplus in India is 84-141 Mt yr<sup>-1</sup> where cereals and fibre crops contribute 58% and 23%, respectively. Remaining 19% is from sugarcane, pulses, oilseeds and other crops. Out of 82 Mt surplus residues from the cereal crops, 44 Mt is from rice followed by 24.5 Mt of wheat which is mostly burned in fields (Table 1). In case of fibre crops (33 Mt of surplus residue) approximately 80% is cotton residue that is subjected to burning. The surplus residues i.e., total residues generated less residues used for various purposes, are typically burned in the field or used to meet household energy needs by farmers.

Table 1. Generation & surplus of crop residues in various states of India (Mt yr<sup>-1</sup>).

States	Residue generation (MNRE, 2009)	Residue surplus (MNRE, 2009)	Residue burned (IPCC coeff.)	Residue burned (Pathak et al. 2010)
Andhra Pradesh	43.89	6.96	5.73	2.73
Arunachal Pradesh	0.4	0.07	0.06	0.04
Assam	11.43	2.34	1.42	0.73
Bihar	25.29	5.08	3.77	3.19
Chhattisgarh	11.25	2.12	1.84	0.83
Goa	0.57	0.14	0.08	0.04

Gujarat	28.73	8.9	6.69	3.81
Haryana	27.83	11.22	5.45	9.06
Himachal Pradesh	2.85	1.03	0.20	0.41
Jammu and Kashmir	1.59	0.28	0.35	0.89
Jharkhand	3.61	0.89	1.11	1.10
Karnataka	33.94	8.98	2.85	5.66
Kerala	9.74	5.07	0.40	0.22
Madhya Pradesh	33.18	10.22	3.46	1.91
Maharashtra	46.45	14.67	6.27	7.41
Manipur	0.9	0.11	0.14	0.07
Meghalaya	0.51	0.09	0.10	0.05
Mizoram	0.06	0.01	0.01	0.01
Nagaland	0.49	0.09	0.11	0.08
Orissa	20.07	3.68	2.57	1.34
Punjab	50.75	24.83	8.94	19.62
Rajasthan	29.32	8.52	3.58	1.78
Sikkim	0.15	0.02	0.01	0.01
Tamil Nadu	19.93	7.05	3.55	4.08
Tripura	0.04	0.02	0.22	0.11
Uttarakhand	2.86	0.63	13.34	21.92
Uttar Pradesh	59.97	13.53	0.58	0.78
West Bengal	35.93	4.29	10.82	4.96
India	501.76	140.84	83.66	92.81

#### 1.1.4. Major Reasons for burning crop residues in field by farmers

Increased mechanization, particularly use of combine, declining number of livestock, long period required for composting and no economically viable alternate use of residues are some of the reasons for residues being burnt in field. The number of combine harvester in the country, particularly in the IGP has increased dramatically from nearly 2000 in 1986 to 10000 in 2010. North-Western part (Punjab, Haryana and western Uttar Pradesh) of the IGP has about 75% of the cropped area under combine harvesting. Combine harvesters are used extensively in central and eastern Uttar Pradesh, Uttarakhand, Bihar, Rajasthan, Madhya Pradesh and southern states as well for harvesting rice and wheat. The major reasons for increase in use of combine are labour shortage, high wage during harvesting season, ease of harvesting and thrashing and uncertainty of weather. With combine harvesting, however, about 80% of the residues are left in the field as loose straw that finally ends up being burnt. It is estimated that about 15 Mt rice straw is burned every year in Punjab alone.

##### Major reasons of stubble burning

- In Indo Gangetic Plains, the wheat straw is preferred for dry fodder than Paddy straw
- Highly mechanized farming practices in harvesting operations
- Govt policy on cultivation of paddy
- Labour shortages and higher wages during harvesting due to MNREGA
- Uncertainty of weather
- Farmers consider it as a soil fertility enhancement and pest control measures.
- Poor storage facility for the straw
- Higher transportation cost
- Lack of awareness among farmers about other economic use

#### 1.1.5. Outline the economic, social, development and climate change

Burning of agricultural biomass residue, or Crop Residue Burning (CRB) has been identified as a major health hazard. In addition to causing exposure to extremely high levels of Particulate Matter concentration to people in the immediate vicinity, it is also a major regional source of pollution, contributing between 12 and 60 per cent of PM concentrations as per various source apportionment studies. In addition, it causes loss of vital components such as nitrogen, phosphorus, sulphur and potassium from the topsoil layer, making the land less fertile and unviable for agriculture in the long run. About 25% of nitrogen, 25% phosphorus, 50% of sulphur and 75% of potassium uptake by cereal crops are retained in residues, making them valuable sources of nutrients.

##### a). Economic impact

Crop residue is not a waste but rather a useful natural resource. About 25 % of nitrogen (N) and phosphorus (P), 50 % of sulphur (S) and 75 % of potassium (K) uptake by cereal crops are retained in crop residues, making them valuable nutrient sources. Sidhu et al. (2007) estimated the quantity of nutrients available in rice. According to his study, the paddy straw has 39 kg/ha N, 6 kg/ha P, 140 kg/ ha K and 11 kg/ha S. Sidhu and Beri (2005) shared their experience with managing rice residues in intensive rice-wheat cropping system in Punjab. According to them, the

approximate amount of the nutrients present in the straw, which was burnt in 2003–2004 were 106, 65 and 237 thousand tonnes respectively of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O in addition to secondary and micronutrients.

The removal of the paddy stalk that remains on the field is a labour-intensive process. With labour being unavailable and the time window for preparing the field for wheat cultivation being limited, the options that the farmer has are either investing in expensive and rarely used agricultural implements, or burning the residue right on the field. Of the two, the latter is both cheaper and requires less effort.

## **b). Social impact**

**a). Health impact** - Burning of crop stubble has severe adverse impacts especially for those people suffering from respiratory disease, cardiovascular disease. Pregnant women and small children are also likely to suffer from the smoke produced due to stubble burning. Inhaling of fine particulate matter of less than PM<sub>2.5</sub> µg triggers asthma and can even aggravate symptoms of bronchial attack. According to Singh et al. (2008), more than 60 % of the population in Punjab live in the rice growing areas and is exposed to air pollution due to burning of rice stubbles. As per the same study, medical records of the civil hospital of Jira, in the rice-wheat belt showed a 10 % increase in the number of patients within 20–25 days of the burning period every season.

## **c). Climate Change Impact**

Agricultural crop residue burning contribute towards the emission of greenhouse gases (CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>), air pollutants (CO, NH<sub>3</sub>, NO<sub>x</sub>, SO<sub>2</sub>, NMHC, volatile organic compounds), particulates matter and smoke having direct influence on global warming. Furthermore, it depletes the soil of its organic matter, major nutrients and reduces microbial biomass in soil that ultimately impairs the efficacy of organic matter application in the next cropping season. It is estimated that burning of one tonne of rice straw accounts for loss of 5.5 kg of nitrogen, 2.3 kg of phosphorus, 25 kg of potassium and 1.2 kg of sulphur. The heat generated elevates the temperature of soil and thus, killing fungi, pests, reptiles and the like that are otherwise beneficial for the crops. (The Times of India, May, 10, 2015).

So concentration of GHGs in the region lead to rise in temperature or local warming which ultimately affect the various climatic parameter in the region.

### **1.1.6. Efforts taken so far**

In terms of efforts being made to reduce crop residue burning, the following approaches have been used by various state and central administrations and regulatory bodies so far:

**Banning Crop Residue Burning:** Crop residue burning was notified as an offence under the Air Act of 1981, the Code of Criminal Procedure, 1973 and various appropriate Acts. In addition, a penalty is being imposed on any offending farmer. Village and block-level administrative officials are being used for enforcement.

**Detection and prevention:** A combination of remote sensing technology—use of satellite imagery—and a team comprising local officials—Sub-Divisional Magistrates, Tehsildars, Block Development Officers, Patwaris and village-level workers—is being used to detect occurrences of crop residue burning in real-time and to prevent them from taking place.



**Establishment of a market place for crop residue burning :**Efforts are being made to increase the avenues for the alternate usage of paddy straw and other crop residue. For instance, paddy straw has a considerable calorific value, making it suitable for use as a fuel in biomass-based power plants. Similarly, it can be utilised for the preparation of bio-fuels, organic fertilisers and in paper and cardboard making industries. The strategy, broadly, is to assign a real economic and commercial value to the agricultural residue and making burning it an economic loss to the farmer.

**Outreach and public awareness campaigns:** There are ongoing efforts to highlight the health effects of crop residue burning. It produces extremely high levels of toxic particulates, which affect the health of the people in the direct vicinity of the burning. In addition, efforts are also being made through kisan camps, trainings and workshops, apart from campaigns through various print media, televised shows and radio jingles, in informing farmers about the alternative usage of crop residue.

**Subsidy on agri-implements:** The state governments, in collaboration with the Centre, has rolled out schemes for providing subsidy on mechanical implements that help tillage of soil, so that the crop residue can be retained in the soil, adding to its fertility, or alternately, collection of crop residue for putting it to commercial usage. However, the high cost of these implements means that in spite of subsidies, only a small number of farmers have access to these implements at the moment.

**Crop Diversification:** There are various ongoing, long-term efforts at diversification of cropping techniques, such that crop residue burning can be effectively prevented. This is being attempted through cultivation of alternate crops (apart from rice/paddy and wheat) that produce less crop residue and have greater gap periods between cropping cycles.

### 1.1.7 Analysis and vulnerability analysis ;

Burning of crop residue releases the GHGs in the atmosphere. Emissions of GHGs was determined on basis of product of emission factors and crop residues burnt (Based on IPCC Coefficient) . The carbon dioxide is the most dominant among three gases.

Name of the Gas	Emission factors of crop residues (g/kg)
Carbon dioxide (CO <sub>2</sub> )	1515
Methane (CH <sub>4</sub> )	2.7
Nitrous Oxide (N <sub>2</sub> O)	0.07

CO appeared to be most critical as concentrations of 114.5 mg/m<sup>3</sup> or more were observed at 30 m distance from burning fields and 20.6 mg/m<sup>3</sup> CO was recorded at residences even 150 m away. Given that the permissible limit of CO in ambient air is 4.0 µg/m<sup>3</sup>, this was a major health hazard for residents and road travellers in the area. Further, particulates were also being released in large quantities. PM<sub>2.5</sub> ranged between 146 and 221 µg/m<sup>3</sup> in critically affected areas and average PM<sub>10</sub> values were found 300 µg/m<sup>3</sup>, against a permissible limit of 60 µg/m<sup>3</sup> for residential rural areas.

### Adverse impacts of crop residue burning – An Analysis

The problem of crop residue burning has been intensifying over time and spreading across the Indian Sub-continent. The NASA satellite images of early November 2016 (peak period of rice residue burning) depicts the burning hot spots across south Asia and shows that the intensity of crop residue burning in Punjab, Haryana, western Uttar Pradesh and Uttarakhand is very high, resulting in deterioration of air quality in vast geographical area. Crop residue is contributing to atmospheric pollution that has serious environment, soil, and human health as well as economic implications due to release of large amounts of air pollutants.

### **A) Environment**

The major pollutants emitted by crop residue burning - CO<sub>2</sub>, CO, CH<sub>4</sub>, N<sub>2</sub>O, NO<sub>x</sub>, SO<sub>2</sub>, black carbon, non-methyl hydrocarbons (NMHC), volatile organic compounds (VOC) and particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), contribute enormously to global warming. Extensive crop burning, resulted in Delhi air becoming the most polluted in the World in the first week of November 2016, compelling the Government to declare Delhi air pollution an emergency ([www.theguardian.com/World/India](http://www.theguardian.com/World/India)). It is estimated that one tonne rice residue on burning releases 13 kg particulate matter, 60 kg CO, 1460 kg CO<sub>2</sub>, 3.5 kg NO<sub>x</sub>, 0.2 kg SO<sub>2</sub>. The black carbon emitted during residue burning warms the lower atmosphere and it is the second most important contributor to global warming after CO<sub>2</sub>.

### **B) Soil health**

Apart from the damage caused by air pollution, burning of rice residue also results in loss of soil organic matter and plant nutrients and adversely affects soil health. About 90% of N and S and 15-20% of P and K contained in rice residue are lost during burning. Burning of 23 million tonnes of rice residues in NW India leads to a loss of about 9.2 million tonnes of C equivalent (CO<sub>2</sub>-equivalent of about 34 million tonnes) per year and a loss of about 1.4×10<sup>5</sup> t of N (equivalent to Rs 200 crores) annually. In addition, in-field burning of crop residues also destroys the beneficial micro-flora and fauna of soil causing adverse impact on soil health.

### **C) Human & Animal health**

According to Gadde et al. (2009), open burning of crop stubble results in the emissions of harmful chemicals like polychlorinated dibenzo-p-dioxins, polycyclic aromatic hydrocarbons (PAH's) and polychlorinated dibenzofurans (PCDFs). These air pollutants have toxicological properties and are potential carcinogens. Furthermore, the release of carbon dioxide in the atmosphere due to crop stubble burning results in the depletion of the oxygen layer in the natural environment causing green house effect. Burning of crop waste also has adverse implications on the health of milk producing animals. Air pollution can result in the death of animals, as the high levels of CO<sub>2</sub> and CO in the blood can convert normal haemoglobin into deadly hemoglobin. There can also be a potential decrease in the yield of the milk producing animals.

Increase in the concentration of PM<sub>2.5</sub> and PM<sub>10</sub> during the large scale burning of rice residues is a major health hazard. For example, the children are more sensitive to air pollution (smog), as rice residue burning poses some unrecoverable influence on their pulmonary functions. The emission of high levels of PM<sub>2.5</sub> and PM<sub>10</sub> in the air causes chronic diseases like cardiopulmonary disorders irrecoverable lung capacity or asthma in human population of NW India. The survey and economic

evaluation showed a clear increase in medical and health-related expenditure and workdays lost during the rice residue-burning period (September–November) each year in Punjab. These health-related expenditures tend to be higher for children, older people and farm workers who are directly exposed to rice residue burning. The human health costs from rice residue burning in rural areas of Punjab are estimated at Rs. 7.61 crores annually. The costs would be much higher if expenses on averting activities, productivity loss due to illness, monetary value of discomfort, etc., are also included. (National Academy of Agricultural Science – Policy Brief No. 2)

### 1.1.8. Project Location details – villages, block/ mandal district:

The proposal will be implemented in the State of Punjab & Haryana and Partly in Rajasthan & Uttar Pradesh. All the districts of Punjab, major paddy growing districts of Haryana and potential areas for end use of crop residue (particularly of paddy straw) have been identified and will be covered. The ultimate aim is to enhance the climate resilience among farmers by strengthening soil fertility, organic carbon, lesser use of chemical fertiliser and enhanced income through diversified farming like dairy activities in drought prone areas.

**a). Status in Punjab:** It was observed that straw burnt area in 2015 was around 17.93 lakh ha and districtwise status is given below;

Table.1. District-wise area under residue burning in Punjab -2014 & 2015 ('000 ha.)

Name of Districts	Burnt Area 2014	Burnt Area 2015
Amritsar	100.95	78.92
Barnala	98.92	89.82
Bathinda	98.31	77.49
Faridkot	87.09	75.35
Fatehgarh Sahib	58.01	57.26
Fazilka	74.21	58.11
Firozpur	165.74	144.99
Gurdaspur	78.59	61.26
Hoshiarpur	46.13	22.23
Jalandhar	82.01	67.16
Kapurthala	81.27	78.69
Ludhiana	180.52	170.18
Mansa	59.79	41.88
Moga	155.83	141.21
Muktsar	105.6	85.18
Pathankot	12.62	9.99
Patiala	165.29	138.55
Rupnagar	14.87	13.59
Sangrur	227.21	202.83
Sas Nagar	23.12	14.45
Sbs Nagar	32.08	28.75
Tarn Taran	147.79	134.61
<b>State</b>	<b>2095.95</b>	<b>1792.51</b>

Source : Monitoring residue burning through Remote Sensing 2015, Punjab Remote Sensing Centre

**b).Status in Haryana**

During 2015-16, the total paddy cultivated area in Haryana is estimated at 12.76 lakh hectare in about 20 districts. The maximum area under paddy cultivation was in Karnal district (13.52%) followed by Kaithal (12.65%), Jind(9.63%), Kurukshetra(9.37%), Fatehabad (7.80%) and Sonapat(6.91%), Sirsa(6.37%), Panipat(5.88%) and Yamuna nagar (5.50%), respectively. These districts consisted of 84% area of total paddy cultivated area in the State. A study on “Area estimation of paddy stubble burning in ten major paddy growing districts of Haryana” by Majoj et.al highlighted that 10 major paddy growing districts of Haryana state which contribute more than 80% of paddy cultivated area are affected with paddy straw burning and in around 20% of paddy cultivated area the paddy straw is burnt. Districtwise details of paddy straw burnt area reported in Year 2013 is given as under:

**Table 2. Major Paddy Growing Districts of Haryana (2013)**

Sr. No.	Districts	Paddy area (000 ha)	Stubble Burning area (000 Ha)	% Burnt area of Paddy Cultivated area
1	Ambala	79	12.27	15.5
2	Fatehabad	93	32.68	35.1
3	Jind	118	4.17	3.5
4	Kaithal	158	41.42	26.2
5	Karnal	162	54.32	33.5
6	Kurukshetra	118	39.82	33.7
7	Panipat	62	0.81	1.3
8	Sirsa	68	19.61	28.8
9	Sonapat	100	1.23	1.2
10	Yamuna Nagar	69	1.98	2.9
	Total	1027	208.31	20.3

*Source : Journal of Geomatics, Vol.9, No.1 April 2015, Page 59.*

### **c) Crop Residue in the State of Rajasthan:**

In Rajasthan agriculture continues to play a prominent role in the employment with 62% of the total workers of the State engaged in Agriculture [census 2011]. As per a study conducted by IARI on “Crop Residues Management with Conservation Agriculture: Potential, Constraints and Policy Needs”, in the state of Rajasthan, as per IPCC coefficient a total of 13% crop residue is burnt of the total crop residue generation and 6% as per the Pathak et.al.2010 estimates. Agriculture Ministry issued an advisory to the state governments to create awareness among the farmers about the harmful effect of straw burning.

### **Feed resources in Rajasthan - Availability vs. Requirement**

In Rajasthan, dairying is the most reliable source of earning to farmers. The livestock keepers have traditionally relied on common grazing lands “gochars”, scared groves “orans” and forests. The permanent pastures and other grazing land reduced from 1.9 million ha. in 1990-91 to 1.7 million ha in 2009-10. With disappearing grazing land, restricted forest and stall feeding, the bovine are facing a severe shortage of fodder. Now the dairy farmers are shifting from extensive open

grazing system to semi-intensive and intensive stall feeding system which require huge quantity of dry matter/fodder in addition to green fodder. The year wise status of availability, requirement and surplus/deficit of Dry Matter in Rajasthan is as under :-

Year	Dry Matter ('000MT)		
	Availability	Requirement	Surplus/Deficit
1992	33571	55046	-21475
1997	35848	66634	-30786
2003	29523	66153	-36330
2007	45655	74298	-28643
2008	47310	76464	-29154
2009	47052	78929	-31877
2010	38218	81703	-43485
2011	40809	84808	-43999

(Source: Dairying in Rajasthan- A statistical Abstract 2016 - NDDDB report)

As indicated in above table, there has always been shortage of dry matter (dry fodder) for animal consumption in Rajasthan. District wise data analysis also indicates shortage of dry matter in all district of Rajasthan. This scenario indicates a great potential for distribution of dry matter in deficit areas and processing/conversion of dry matter into nutritious fodder for animals. The existing infrastructure consisting of PACS, FPOs (145 nos.), Farmers Club, Dairy Cooperatives, NGOs, etc. can be used for awareness creation and making available the crop residue from nearby state for the dairy farmers of Rajasthan. These initiatives may requires viability gap support initially. The existing dairy cooperative structure is proposed to be used for the collection, distribution and processing of fodder. Detailed note on crop residue in Rajasthan is given in the Annexure 5.

#### d) Crop Residue Burning in Uttar Pradesh

The total cereal crop residue generated in Uttar Pradesh is estimated 72 million tonnes for cereal crops mainly paddy and wheat (1) which is highest in the country. Following table indicates crop residue production in Uttar Pradesh in the districts in NCR region.

**Table: Agriculture residue production form Major crops in NCR region of Uttar Pradesh**

S.N.	District	Crop residue production MT /year
1	Meerut	4322416.06
2	Bagpat	2564785.37
3	B.Shahar	3745476.46
4	Ghaziabad	847624.38
5	G.Buddha Ngr.	531632.46
6	Hapur	1411224.86
7	Muzaffarnagar	5488800.04

<sup>1</sup> Jain et al., Aerosol and Air Quality Research, 14: 422–430, 2014

<b>Total</b>	<b>18911956.63</b>
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Above table shows the annual agricultural residue production from different districts of NCR regions of Uttar Pradesh. The project would focus on these 5 to 7 districts for addressing the issue of crop residue management.

### **1.1.9. Demographic details of the population**

#### **a). Punjab State**

Punjab is the home to 2.77 crore (2011 Census) people, constituting 2.29% of the total population, covering 1.54% surface area of the country. 62.52% of the State's population lives in rural areas. Males outnumber the females in Punjab with the sex ratio of 895 females to every 1,000 males, with the highest sex ratio in Hoshiarpur (961) and lowest in Bathinda (868). The State is more densely populated (551 persons/km<sup>2</sup>) than the country's average (382 persons/km<sup>2</sup>). About 75.8% of the State's population is literate as against the national average of 74%. Though agriculture is the predominant economic activity in the State, it engages only 36% of the State's work force as against about two third at national level. Migration of rural people to foreign countries in search of jobs has resulted in reduction in the workforce available for agriculture. Shortage of farm labour has prompted farmers of the State to go for farm mechanization in a big way.

Total operational holdings in state during the last five years period increased by 55 thousands from 10.03 lakh to 10.58 lakh. Point worth noting is the marginalization of holdings with proportionate increase in marginal and small farmers. The proportion of marginal and small holdings which was 13.36 and 18.25 per cent in 2005-06 increased to 15.50 and 18.53 per cent, respectively. On the other hand, the proportion of holdings in all other categories viz. semi-medium, medium and large had been declined during this period. Over this period the average holding size in state also went down from 3.95 ha to 3.78 ha.

Punjab has the lowest BPL rate (11.3%) as against the country's average at 29.5%. The per capita income in the state at current prices increased by 8.96% from Rs. 1,05,143/- in 2013-14(P) to Rs.1,14,561 in 2014-15(Q) and is likely to be Rs.1,26,063 for 2015-16(A) registering a growth of 10.04% over the previous year.

Rice, which occupied around 6.87 per cent of the gross cropped area in 1970-71, increased to over 33.15 per cent in 2007-08, and then rose further to around 35.85 per cent in 2010-11. The increase in wheat cultivation has been at the cost of gram, rapeseed and mustard, while that of rice has been obtained by shifting the area from maize, groundnut, millets and cotton. Total food grain production over this period increased by more than three and half times. Yields of wheat, paddy and total food grains nearly doubled over this period of time (1971 to 2011). Besides, production of cotton, potato and milk during this period has been gone up by 1.76, 7.24 and 4.47 times, respectively. On the other hand, the production of pulses and oilseeds went down drastically over this period and that of sugarcane with some variations remained almost same. The reason of decline of production of these crops was the drastic decline of area under these crops due to encroachment by paddy and wheat.

#### **b). Haryana State**

The total population of the State as per census 2011 is 2.54 crore, with male population constituting 53.24% and female population 46.76%. The population

density of the State is 573 persons per sq. km. The density in urban area is high at 4,475 persons per sq. km whereas the same for rural area is 391. 20% of the total population belongs to SC/ST category.

About 65% of Haryana's population lives in villages. The percentage of rural population has come down by about 6 % since 2001. Faridabad with less than 21% rural population is the most urbanized district whereas Mewat with more than 88% rural population is least urbanized.

As per Haryana Statistical Abstract 2014-15, total reported area of the State is 44.21 lakh ha, total cultivable area is 36.45 lakh ha out of which net sown area is 34.97 lakh ha, which is 96% of total cultivable area and 79.10 per cent of total reported area. Gross cropped area is 64.71 lakh ha and gross irrigated area is 57.08 lakh ha with Cropping Intensity of 185%. The State is having 16.17 lakh land holdings.

### **c). Rajasthan State**

It is home to 6.85 crore populace, of which 75.13% reside in rural Rajasthan, the population density is 200 persons per sq.km. Literacy level is 66.11%. There are 1.67 crore people in BPL category in State against 35.47 Crore people at all India level which consists of 24% of total population of the State. Ten districts viz., Udaipur, Banswara, Dungarpur, Barmer, Bikaner, Jodhpur, Jalore, Bhilwara, Sriganganagar and Chittorgarh comprise 50% of BPL population.

Total landholding area is 211.36 lakh ha. with number of 68.88 lakh land holdings in the State in 2010-11. Area under marginal, small, semi medium and medium landholding categories has increased by 21.85%,14.09%,5.71% and 1.80% respectively in comparison to 2005- 06 contrary to decrease in large land holdings by 8.07%. However, the average size of land holding in the state is 3.07 ha.

About 5.4 million households continue to be engaged in farming, of which roughly half are small or marginal farmers. Increasing agricultural productivity (water, land, labour) is critical for the future of the agriculture sector in Rajasthan.

As per the cropping pattern in the state, the crop groups such as total cereals, oilseeds, pulses and fodder crops account for about 42 per cent, 21 per cent, 18 per cent and 15 per cent of GCA respectively during the year 2010-11.

### **d). Uttar Pradesh State**

As per census 2011, the population of Uttar Pradesh was 19.98 crore of which 77.73 percent lived in rural areas followed by 22.27 percent in urban areas. The percentage of rural population of U.P. was higher than national figure of 68.84 percent. The total population of workers was 3.93 crore in 2001 in U.P. of which cultivators accounted for 46.98 percent followed by 15.14 percent, 5.32 percent, and 32.56 percent of agricultural labours, workers of industries and workers engaged in other services respectively.

The rice, wheat, bajra, barley and maize are important cereal crops in the state. Out of total GCA, 258.22 lakh hectares during 2012-13 in U.P. wheat accounted for highest share being 37.90 percent followed by 22.83 percent, 3.57 percent, 2.68 percent, 0.69 percent and 0.64 percent of rice, bajra, maize, jowar and barley respectively.

The distribution of size of holdings is very much uneven in the state out of total operational holdings of 23325 thousand, the marginal holding accounted for 79.45 percent followed by 13.02 percent, 5.71 percent, 1.71 percent and 0.11 percent of small, semi medium, medium and large holdings respectively



## **1.2 Project / Programme Objectives:**

The crop residue management has been a major concern in India particularly in those areas where residue of cereal crops are available in both the cropping seasons (Kharif & Rabi). So burning of surplus residue is posing major challenge due to changing global scenario on climate variability. Hence sustained efforts and implementable interventions needs to be taken up to improve the climate resilience among farmers. So, the following broad objectives of the proposal are as under:

- ✓ To lower Green House Gases Emissions in project areas by i). creating awareness among farmers through crop residue management and by ii). Promoting alternate uses of crop residue.
- ✓ To promote implementable and sustainable entrepreneurship models in rural areas by engaging FCs/ FPOs /PACs/ JLGs/Dairy Cooperatives/ Water Users Associations/ Individual entrepreneurs for effective crop residue management through upscaling successful initiatives and innovative ideas.
- ✓ To enhance the climate resilience and income of the farmers through alternative uses of crop residue management in project areas.
- ✓ To identify the other co-benefits and suggest policy intervention.

## **1.3 Details of National Implementing Entity (NABARD)**

NABARD came into existence on 12 July 1982 by transferring the agricultural credit functions of RBI and refinance functions of the then Agricultural Refinance and Development Corporation (ARDC). Set up with an initial capital of Rs.100 crore, its' paid up capital stood at Rs. 8300 crore as on 31 March 2017. Consequent to the revision in the composition of share capital, it is fully owned by Government of India. NABARD has been involved in effective credit support, related services, institutional development for agriculture and rural livelihood sectors. Refinance has been core function of NABARD and various long term investment activities are supported by NABARD through its refinance. NABARD has been working with various financial institutions and has been closely involved in various initiatives of Government of India aimed to capital formation in rural and agriculture sector through private investments.

NABARD has always taken into consideration social and environmental concerns to achieve the desired development results apart from channelizing and accelerating agriculture credit. It has taken various policy and developmental initiatives to achieve the environmental sustainability for rural prosperity and some of initiatives are as under ;

- a) Watershed Development Fund
- b) Tribal Development Fund (For promotion of Orchard i.e. Wadi)
- c) Umbrella Programme on Natural Resource Management (UPNRM)
- d) Promotion of PACS as Multi Service Centre
- e) SHG-Bank Linkage Programme
- f) Promotion of Farmers Producer Organisation in Rural Areas.

Some of the recently taken important steps by NABARD are related to accessing national and international funding mechanism to fulfil the need of climate finance. NABARD has been accredited as National Implementation Entity (NIE) for Adaptation Fund (AF) and Direct Access Entity (DAE) for Green Climate Fund

(GCF) under UNFCCC. Moreover, NABARD is acting as designated NIE under National Adaptation Fund for Climate Change (NAFCC). A separate chapter on Climate Change has been incorporated in Potential Linked Credit Plan (PLPs) of each district from 2017-18 wherein the details of climate change challenges being faced at the district level and the activities which can be supported through public & private investment under climate finance are given. The same would facilitate integrating of climate concerns in credit planning.

**Launching of Water Campaign :** Water Campaign was launched from 22 March to 30 June 2017 in 1 lakh villages with the help of 8000 Jaldoots and 200 Master Trainers to create awareness among villagers about water use efficiency, water harvesting & conservation, etc. Water campaign was a good example of mobilising action through education.

### **Loans to State Govts for Rural Infrastructure**

NABARD also provides loans from the Rural Infrastructure Development Fund (RIDF) with the sole objective of giving low cost fund support to State Govts. and State Owned Corporations. Over the last nearly two decades, RIDF has financed nearly one fifth of India's total rural infrastructure. NABARD provides financial assistance to the State Governments for projects covering 36 activities broadly classified under 3 heads viz. Agriculture & Related Sector, Social Sector and Rural Connectivity. RIDF Tranche I, was placed with NABARD during 1995-96 with an allocation of Rs. 2,000 crore. The annual corpus has now reached to Rs. 25,000 crore under RIDF XXII (2016- 17).

#### **Cumulative Sanctions as on 31.03.2017 (in US \$ Billion).**

<b>Particulars</b>	<b>No of projects Sanctioned</b>	<b>RIDF amount Sanctioned</b>
Rural Infrastructure Development Fund (RIDF)	599,849	INR 287,129 crore (US \$ 44.00 Billion)

### **Initiatives of NABARD for Crop Residue Management**

**Crop residue management in Punjab:** NABARD Initiatives- NABARD partnering with NGOs, has piloted a few initiatives to discourage farmers from crop residue (paddy straw) burning:

A. In situ Composting of Paddy in Ludhiana District: Sanctioned to Punjab Agricultural University with a grant assistance of Rs. 12.42 lakh. The project envisages to address the concern of paddy straw burning in three villages through demonstration and popularising in-situ paddy straw composting technology. Interventions under the project include selection of 30 farmers @10 farmers from each identified villages for setting up composting units, technical support to the selected farmers for preparation of compost from paddy straw collected from one acre field, sowing of wheat with happy seeder /zero till drill and application of compost to the succeeding crops, organising field days and training camps to sensitize a minimum of 400 farmers from each of the selected three villages on the advantages of in-situ composting (1200 farmers will be indirectly benefitted by way of training and demonstration) and analysis of compost samples for NPK content and soil samples before and after compost application.

B. Rice Crop Residue Management in Sri Muktsar Sahib district: sanctioned to Jwala Bhai Nathu Ram Ahuja (JBNRA) Educational and Charitable Trust, which carried a grant assistance of Rs 10.00 lakh. Under the project, training was imparted to 2281 farmers through 77 village level training programmes. The villagers were educated about ill effects of paddy straw burning and about alternate methods of straw management – use of straw choppers, Turbo Happy Seeder, Rakes and Balers etc. 25 demo plots were selected for demonstrating the alternate methods of paddy straw management. Team of experts from PAU and JBNRA Trust were involved in sensitising the farmers. As a result of the awareness created under the project, majority of the 2281 farmers covered under the project (who had burnt straw during the previous year), have stopped the practice and adopted alternate methods. Likely area to be covered through these alternate methods during 2015 is 9000 acres in Sri Muktsar Sahib and the likely economic benefits accruing to farmers if straw is not burnt has been assessed at Rs 5151 per acre (by way of saving in machinery use, fuel for pumping out excess water, increase in organic content of soil, increase in yield) etc.

c. Project for improvement of design of paddy straw chopping machine: sanctioned to Punjab State Council for Science and Technology (under RIF) which carries a grant assistance of Rs. 19.40 lakh. The project aims at study of the metallurgy of existing paddy straw machines, design of new blades with improved metallurgy and demonstration of improved chopping machine in one briquetting plant. The project is in ongoing stage. The proposed improvement in the design / metallurgy of blades will bring down the processing (chopping) cost of paddy straw, thereby making it an economically viable option for use of paddy straw briquettes in brick manufacturing units, in comparison to the prevalent use of coal / loose biomass. This would entail an increase in demand for paddy straw choppers & briquetting machines being used in biomass based power plants and also in paddy straw briquettes being supplied as fuel to brick kiln and boilers.

D. Eco friendly management of paddy straw: sanctioned to Suraksha Agricultural and Rural Development Society (SARDS) which carries a grant assistance of Rs. 7.43 lakh. The project aims at creating awareness in four villages by mobilising 100 farmers (1 acre plot each) and demonstrating eco-friendly solutions / ways (compost making, use of happy seeder, shredder etc.) of managing plant residue in those 100 farm plots. Demonstrative effects to other farmers are to be achieved through organising awareness camps, field day training, exposure visits etc.

**1.4. Details of Executing Entity :** The following executing entities/sub entities have been identified in concerned states which will prepare implementation strategies in the Ist quarter after sanction of proposal.

- i) **Punjab State**
  - a. Department of Agriculture / PSCT/ GADVASU/PAU
- ii) **Haryana State**
  - a. Department of Agriculture/ HAU
- iii) **Rajasthan State**
  - a. Department of Agriculture /AH
- iv) **Uttar Pradesh**
  - a. Department of Agriculture/ Bio Energy Board

#### **1.4.1 Three largest community based NRM based projects handled:**

##### **A. Punjab State**

Project	Objectives & geo. coverage	Amount Sanctioned	Funding Agency	Geographical Coverage	Implementation Period & Outcome
Preparation of SAPCC for Punjab	To prepare state level Strategy and Action Plan on Climate Change as per National Framework covering 8 Missions	Rs.10.00 lacs	Ministry of Environment, Forests & Climate Change, Govt. of India	Punjab State	2011-12 to 2013-14. Prepared SAPCC involving concerned departments with technical support from GIZ.
Capacity Building of SAPCC	To develop capacities and take up activities for effective implementation of SAPCC involving concerned departments	Rs.10.00 lacs	MoEF&CC, GoI	Punjab State	2014-15 to 2015-16. Three capacity building workshops for stakeholder departments conducted. Meetings for identification and formulation of projects on climate change adaptation and mitigation organized involving experts from GIZ and NABARD.
Gainful Utilization of Paddy Straw as fuel in brick kilns	Initiative for Management and Utilization of Paddy Straw including technology development for briquette making.	Rs.58.00 lacs	PPCB	Punjab State	2014-15 Trials conducted for utilization of paddy straw in the briquette form in brick kilns as an alternative fuel to replace coal.

#### 1.4.2 Three largest community based NRM based projects handled

PSCST, in collaboration with, Unati Cooperative Marketing-cum-Processing Society Ltd., Talwara had taken up a DBT-GOI supported project for promoting cultivation & value addition through post-harvest processing of bio-resources (medicinal, aromatic & horticultural crops) in Shivalik belt. DBT, GOI supported the project for the period 2004-07. Subsequently, with vigorous efforts, the processing unit set up under the project was made self-sustainable and a 3 years' agreement was signed with Unati for its operationalization which has been renewed this year for a period of ten years.

Punjab Energy Development Agency (PEDA) had awarded a project for preparation of PDD and PCN for their project on “1 MW solar power plant at village Phulokhari, District Bhatinda”. During the year, the Council has prepared and submitted PDD to PEDA. The Council also worked out “Carbon Footprint Estimates” for Punjab Cricket Association (PCA), S.A.S.Nagar for one of the IPL-2009 matches held at PCA Stadium, S.A.S. Nagar declared as Green Match.

### 1.4.3 Three largest Climate Change Adaptation / NRM projects of State / Central Government

Punjab Biodiversity Board was notified on 23<sup>rd</sup> December, 2004 . The Board is being serviced by PSCST with Executive Director -PSCST as its Member Secretary. The Council is coordinating the scheme “National Wetland Conservation Programme (NWCP)” sponsored by MoEF&CC. Under the scheme, conservation activities were initiated in 1987-88 at Harike wetland, in 1988-89 at Kanjli and in 1998-99 at Ropar. Conservation measures at Nangal were initiated in 2008-09. The activities are taken up through various executing departments which include afforestation of native tree species for habitat improvement, soil conservation to prevent siltation, conservation of wildlife and fisheries, weed control, water quality monitoring and public awareness, etc. RanjitSagar National wetland (which is an interstate wetland of H.P., Punjab and J&K) is being managed by RanjitSagar Dam Design Organisation under Dept.. of Irrigation.

Production and Promotion of Neem based Bio-pesticide as environment friendly biodegradable alternative to chemical pesticides. Under the Neem Project supported by Ministry of Chemicals & Fertilizers, Govt. of India for promotion of neem bio-pesticide, bio-efficacy studies have been carried out in collaboration with PAU for evaluating the effect of Neem Kernel Aqueous Extract (NKAE) on pests of key crops of the state viz. wheat, mustard, cauliflower, pea, cotton, paddy, okra, cabbage / cauliflower & chilli.

### 1.5.Haryana state:

Following important projects are handled in the State by concerned line department

Project	Objectives	Amount Sanctioned (lakhs)	Implementing Agency	Geographical Coverage	Implementation Period & Outcome
Climate Smart Villages (CSV)*	To educate farmers about the interventions related to climate change.	--	CIMMYT, Department of Agriculture, Haryana, DWR, CSSRI	27 numbers of Villages in district Karnal	2013-14

Crop Diversification Programme (CDP)	Alternate crop demonstrations for the replacement of Water Guzzling crops (Rice) etc.	Approx. Rs. 15.00 crore	Department of Agriculture, Haryana	10 numbers of districts having RiceWheat Crop rotation	Since 2013-14
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\*Directly, none of the projects handled were related to climate change but indirectly department has handled the NRM based projects related to adaptation strategies with changing climate. CSV is an initiative by NICRA and CIMMYT and not under the purview of DoA.

Department of Agriculture is implementing following NRM based schemes and programmes:

**Rashtriya Krishi Vikas Yojna (RKVY):** This scheme aims to draw up plans for increased public investment in Agriculture by incorporating information on local requirements, geographical/climatic conditions, available natural resources/ technology and cropping patterns in their districts so as to significantly increase the productivity of Agriculture and its allied sectors and eventually maximize the returns of farmers in agriculture and its allied sectors. This scheme is covering the entire state.

**Crop diversification programme:** This Programme aims to shifting the regional dominance of a single with more than one crops, so ensure food security and meet the demand of food, fruits, vegetables etc. It also aims at improving soil health.

**National Food Security Mission:** The National Food Security Mission aims at enhancing the production of Rice, Wheat, Pulses, Coarse cereals and Commercial Crops.

#### **Details of Project/ Programme Executing Entity \_ Uttar Pradesh State**

**Name :** Uttar Pradesh Bioenergy Development Board Lucknow , **Registered Address -** Room No. 534, 5<sup>th</sup> Floor, Yojna Bhwan Lucknow- 226001.

a) Available technical manpower for the proposed project implementation:

S. N.	Name	Designation	Work Assign
1	P S Ojha	Member convener/ State Coordinator	Monitoring of effective implementation of project
2	R K Shukla	Deputy Project Director	Evaluation of Project and data compilation
3	Dr Virendra Kumar	Deputy Project Director	Evaluation of Project and data compilation

## 1.6 Comment of availability of suitable infrastructure for implementation proposed projects:

Suitable infrastructure is available with the Department of Agriculture/AH and all related sub executing entities of all the States (Punjab, Haryana, Rajasthan and Uttar Pradesh) for implementing the proposed project. Vehicles, computers and required software/tools are purchased as per the demand of the project. The technical manpower is available at block level in every district and for implementing the climate resilient interventions, farmer would be strengthened.

## 1.7. Information on Executing Entity (EE) – whether it was blacklisted, barred from implementation of projects, faced any charges / legal cases related to mismanagement of project and funds:

No.

## 1.8 Project / Programme Components and Financing:

The project will be implemented in 4 States namely Punjab, Haryana, Rajasthan and Rajasthan. The total proposed outlay of the proposal is Rs.1324.47 crore of which Rs. 494.07 crore is proposed as financial support under NAFCC. The state wise support proposed under NAFCC is as under:

Name of States	Total Proposed investment (Rs. crore)	Total Proposed financial support under NAFCC (Rs. crore)
Punjab	1319.42	316.40
Haryana	473.89	188.24
Rajasthan	27.02	20.97
Uttar Pradesh	51.26	23.77
Total	1871.57	549.38

### 1.8.1. Component-wise support requirement from NAFCC

(Rs. Cr)

Sr. No	Interventions Proposed	Punjab	Haryana	Rajasthan	Uttar Pradesh	total NAFCC support requested
1	Incorporation of Straw into soil ( Demonstrations)- Kharif 2018 (Part of Capacity Building programmes of Farmers)	12.150	5.838	0.000	2.813	20.800
2	Incorporation of crop residue in 500000 ha - Kharif 2018 (Major	125.000	50.000	0.000	2.500	177.500

	Interventions)					
3	Setting up of Custom Hiring Units	75.000	62.500	6.250	6.250	150.000
4	Small machineries like happy seeder/ mulcher/ land leveller to individuals through Bank Loan	10.000	10.000	1.000	10.000	31.000
5	Promotional expenses such as identification of PACS/FPOs/ CHCs and finalisation of manufacturers and selection criteria for eligibility.	0.130	0.150	0.015	0.130	0.425
6	Setting up of Fodder Banks	0.000	0.000	11.875	0.000	11.875
7	Diversification of Cropping pattern on Pilot Basis	37.948	22.535	0.000	0.210	60.693
8	Fodder Development/collecti on Units for JLGs/FPOs/ Farmers Club	4.200	4.200	0.000	0.000	8.400
9	Promotional cost of 50 Units (Demonstration/ Urea treatment/ Fodder Blocks/ Exposure visits/ Interface with Surplus and Deficit areas)	0.420	0.420	0.000	0.000	0.840
10	Awareness and Capacity Building of Farmers	8.045	3.045	0.625	0.503	12.218
11	Regional Bio-Residue Management Technology Facilitation Centre	19.091	0.000	0.000	0.000	19.091
12	Regional Bio-Residue Management Technology Facilitation Centre	0.000	12.500	0.000	0.000	12.500
13	Setting up of Biomass based power plant at local level by local entrepreneurs/ local societies/CSOs	6.250	6.250	0.000	0.000	12.500
	<b>Total cost of components</b>	298.234	177.438	19.765	22.405	517.841
	<b>Project Mgt Charges @ 3%</b>	8.947	5.323	0.593	0.672	15.535
	<b>Total Project</b>	307.181	182.761	20.35	23.077	533.376



	<b>Implementation Cost</b>			8		
	<b>NIE fees @ 3%</b>	9.215	5.483	0.611	0.692	16.001
	<b>Total</b>	316.396	188.243	20.969	23.769	549.378

### 1.9. Projected Calendar:

Milestones	Expected Date
Start of Project/ Programme Implementation	1 January 2018
Mid-term Review (if planned)	June – December 2019
Project/Programme Closing	March 2021
Terminal Evaluation	June – December 2021

## 2. PROJECT / PROGRAMME JUSTIFICATION

### 2.1 Component-wise details and justification of the project components

Sr. No.	Interventions proposed	Justifications of suggested interventions
1	Incorporation of Straw into soil ( Demonstrations)	To ensure sustainability of interventions, farmers should be made aware about the likely benefits of incorporation of straw into soil. In this connection the various benefits like enhancing soil fertility through strengthening soil organic carbon, reduction in soil salinity, savings of nutrients and fertiliser costs, enhancement in productivity, etc. will be shown to farmers and results will be documented through soil testing and yield recording.
2	Incorporation of crop residue in 500000 ha - Kharif 2018 (Major Interventions)	To ensure sustainability of interventions, farmers should be made aware about the likely benefits of incorporation of straw into soil. In this connection the various benefits like enhancing soil fertility through strengthening soil organic carbon, reduction in soil salinity, savings of nutrients and fertiliser costs, enhancement in productivity, etc. will be shown to farmers and results will be documented through soil testing and yield The Dept. of agriculture on the basis of demonstrations suggested above would be able to cover large areas and may address the stubble burning very effectively in a very short time through incentivising to farmers.
3	Setting up of Custom Hiring Units with Zero till, laser land leveller, mulcher, baler, (Including strengthening of existing	For effective and timely management of crop residue, technology can play an important role and in this proposal the large size units are proposed to develop sustainable and implementable entrepreneurship model. The

	CHCs) through bank loan	likely promoters of these units have strong or will be having liasoning with the farmers.
4	Small machineries like happy seader/ mulcher/ land leveller to individuals through Bank Loan	For effective utilisation of existing machineries and to nearby location of farmers, the interventions addressing the conservation agriculture such as zero till, mulching, etc have been proposed in the proposal and large areas under this interventions may be covered.
5	Diversification of Cropping pattern on Pilot Basis	Stubble burning has been a major issues as it adversely affects the soil health, human & animal health, microorganism and environment. To address the issues of surplus straw, there is a need to shift the cropping pattern which is having competitive advantage and which may positively benefit to farmers through enhancing of farm income through value addition, strengthening of ground water resources, lower use of power supply, etc.
6	Fodder Development/collection Units for JLGs/FPOs/ Farmers Club and setting up of fodder banks	Crop residue which can be used as fodder may play an important role for climate resilience building of dairy farmers of deficit areas. At the same time collection units, may enhance the income of farmers through selling surplus fodder to deficit areas. The intervention proposed will be a win-win situation for both the areas. The setting up of fodder banks in deficit area would help in providing timely and affordable fodder to dairy farmers in the year of shortages.
7	Awareness and Capacity Building of Farmers	There is a need to create awareness among farmers about the incurred losses due to burning of crop residue/straw/stubble and also to enhance their capabilities so that the crop residue can be converted into assets. In this connection the proposed intervention which will be having varied type of components has been proposed.
8	Regional Bio-Residue Management Technology Facilitation Centre	The various ongoing pilots and technological models will be show cased to the budding or potential entrepreneurs so that varied type of units on location specific may be established and end use of bio mass/crop residue may be ensured. Details on the component are provided in Annexure 4

9	Setting up of Biomass based power plant at local level by local entrepreneurs/ local societies/CSOs (using cow dung and paddy straw or other locally available bio mass)	This interventions which is in practise only few locations may be upscaled and replicated to use the locally available varied type of bio mass/ cow dung/ crop residue and can be set up an income generating activity.
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### 2.1.1 Business-as-usual development for the targeted sector

Traditionally crop residues have numerous competing uses such as animal feed, fodder, fuel, roof thatching, packaging and composting. **Cereal** residues are mainly used as cattle feed. **Rice straw and husk** is used as domestic fuel or in boilers for parboiling rice. The uses for various residues are different in different states. Farmers use residue either themselves or sell it to other landless households or intermediaries, who in turn sell the residues to industries. The remaining residues are left unused or burned in field. In states like Punjab and Haryana where rice residues are not used as cattle feed, large amount rice straw is burned in field. Sugarcane tops in most of the areas is either used for feeding of dairy animals or burned in field. Residues of groundnut are burned as fuel in brick kilns and lime kilns. **Cotton, chilli, pulses and oilseeds** residues are mainly used as fuel for household needs. Coconut shell, stalks of rapeseed and mustard, pigeon pea and jute and mesta, and sun flower are used as domestic fuel. The surplus residues i.e., total residues generated less residues used for various purposes, are typically burned in the field or used to meet household energy needs by farmer. For various purposes the crop residue are used other than the proposed interventions and these are as under:

- Crop residue is used for cooking of human and animal feed
- Crop residue is used as fuel in brick kilns
- Bedding of animals during winter season
- Packing material of sanitary ware
- Burning of crop residue on field

### 2.1.2 Specific adaptation activities to be implemented to reduce the climate change vulnerability compared to the business-as-usual situation

- Incorporation of crop residue into soil for strengthening of soil Organic Carbon and saving in fertiliser consumption
- Lower use of chemical fertilisers in next sowing crop
- Compost making and organic farming
- Use of Conservation Agriculture such as Zero till, mulching, etc.
- Change in cropping pattern and value addition at local level
- Lesser use of ground water
- Fodder availability in deficit areas and in drought years
- Improvement in fodder quality

### 2.1.3 Justification of components as concrete adaptation activities of the project and their contribution to climate resilience

Sr. No.	Concrete Interventions proposed	Justifications of suggested interventions
1	Incorporation of crop residue into soil	<p>various benefits like enhancing soil fertility through strengthening soil organic carbon, reduction in soil salinity, savings of nutrients and fertiliser costs, enhancement in productivity, etc. will be achieved.</p> <p>Climate resilience aspects : Improved soil fertility, retention of soil moisture, enhanced organic carbon which will create better environment for micro- organism, reduced soil erosion, etc.</p>
2	Setting up of Custom Hiring Units with Zero till, laser landleveller, mulcher, baler, (Including strengthening of existing CHCs) through bank loan	<p>For effective and timely management of crop residue, technology can play an important role and in this proposal the large size units are proposed to develop sustainable and implementable entrepreneurship model. The likely promoters of these units have strong or will be having liasoning with the farmers.</p> <p>Climate Resilience : Timely management of crop residue may avoid burning of crop residue and conservation agriculture.</p>
3	Small machineries like happy seeder/ mulcher/ land leveller to individuals through Bank Loan	Climate Resilience through effective utilisation of existing machineries and to nearby location of farmers, the interventions addressing the conservation agriculture such as zero till, mulching, etc
4	Diversification of Cropping pattern on Pilot Basis	Climate Resilience through change in cropping pattern in favour of low duty crops such as pulses/ oilseeds and by enhancing income of farmers through value addition, strengthening of ground water resources, lower use of power supply, etc.
5	Fodder Development/collection Units for JLGs/FPOs/ Farmers Club and setting up of fodder banks	Crop residue which can be used as fodder may play an important role for climate resilience building of dairy farmers of deficit areas. The setting up of fodder banks in deficit area would help in providing timely and affordable fodder to dairy farmers in the year of shortages.
6	Regional Bio-Residue Management Technology Facilitation Centre	The various ongoing pilots and technological models will be show cased to the budding or potential entrepreneurs so that varied type of units on location specific may be established and end use of bio mass/crop residue may be ensured.

7	Setting up of Biomass based power plant at local level by local entrepreneurs/ local societies/CSOs (using cow dung and paddy straw or other locally available bio mass)	This interventions will utilise the locally available varied type of bio mass/ cow dung/ crop residue which would help in strengthening of soil fertility through composting, etc.

## 2.2 Details on Economic, social and environmental benefits project / programme

Components/Activities	Key Benefits (Direct)		
	Social	Economic	Environmental
Incorporation of Straw into soil	Burning of crop residue adversely affect the health of living organisms . The various benefits like enhancing soil fertility through strengthening soil organic carbon, reduction in soil salinity, savings of nutrients and fertiliser costs, enhancement in productivity, etc. are anticipated.	Per ha saving in fertiliser is estimated at Rs. 5924. Expenditure on health due to increased stubble burning will be reduced.	Lesser pollution or GHG emission because of non burning of crop residue,
Setting up of Custom Hiring Units	Easy availability of machineries of varied type at affordable rate.  Employment generation through custom hiring centres.  Effective collection of crop residue.	Affordable prices to farmers, Reduced expenditure or cost of cultivation, etc.	Lower emission and better use of natural resources.
Diversification of Cropping Pattern	Improved ground water table and quality of water, Availability of pulses/ oilseeds at lower rate, improved soil	Enhanced income through value addition to farmers	Reduced emissions

	quality. Employment generation through processing unitsd	Saving in power supply to farmers so power subsidies may be reduced in long term.	
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### 2.3 Sustainability of intervention

The following aspects which are in built in different interventions are the keys of the sustainability.

- a). Awareness among farmers about likely impact of existing cultivation practices and their sustainability
- b). Improved soil fertility and productivity
- c). Improved farm income through value addition
- d). Enhanced climate resilience through ensuring end use of crop residue and timely availability of fodder in deficit areas.

The project implementation mechanism involves, development capacities of the stakeholders as well as involvement of farmers collectives. The same is expected to build the necessary framework for sustainability of interventions proposed under the project.

Importance of soil incorporation in terms of its economic value to build soil fertility, reduced fertilizer requirement and associated cost reduction as well as productivity improvement is expected to ensure adoption of the technology by the farmers.

### 2.4 Analysis of the cost-effectiveness of the proposed project / programme:

The other possible interventions which can be used as alternative for crop residue management are establishment of biomass based units such as biomass based power plants, bio methanol units, Bio char, Eco panel, etc.

The setting up of different units, huge investment is required. Such interventions also requires time for setting up of these units and despite all these interventions the area coverage of utilisation of crop residue will be limited (less than 10 % of cultivated area).

The proposed intervention at not only developed in a such a way they create an opportunity for better management of the crop residue for building resilience of the cropping system. The interventions helps in building soil health and promote sustainable cropping systems. The same would promote efficient resource management, reduced use of inorganic fertilisers, better water management, etc.

So the interventions proposed are very cost effective and address the issue of GHG emissions very effectively.

#### **2.4.2 Allocation to 'investment activities', 'capacity building activities' and 'project management activities' respectively**

<b>Type of Activity</b>	<b>List of activities</b>	<b>Funding Requirement (Rs. Cr)</b>
Investment Activities	<ol style="list-style-type: none"> <li>1. Demonstration of crop residue incorporation in soil</li> <li>2. Soil incorporation</li> <li>3. Custom Hiring Centres</li> <li>4. Support for appropriate farm machineries</li> <li>5. Cropping pattern diversification</li> <li>6. Fodder collection units</li> <li>7. Fodder management</li> <li>8. Biomass power units</li> <li>9. Briquette making unit</li> <li>10. Compost making units</li> <li>11. Pulses processing unit</li> </ol>	<p style="text-align: right;">467.65 (85.12%)</p>
Capacity Building activities	<ol style="list-style-type: none"> <li>1. Activities for capacity building and training</li> <li>2. Workshops</li> <li>3. Awareness programme</li> </ol>	<p style="text-align: right;">50.19 (9.14%)</p>
Project Management Activities	<ol style="list-style-type: none"> <li>1. Management cost of the executing partners, and project cycle management fee of NIE</li> </ol>	<p style="text-align: right;">31.54 (5.74%)</p>

#### **2.5 Alignment with the National and State Action Plans and other Policies / Programmes:**

The Ministry of Agriculture, Government of India, prepared a National Policy for the Management of Crop Residue in 2014. The Policy on measures and approaches to minimize incidence of crop residue burning. It calls for prevention of burning of crop residues, by incentivizing purchase of modern machineries to minimize left-over crop residue in the field, in-situ conservation and mixing of residue in soil to increase soil fertility, multiple uses of crop residue, formulation of fodder pellets and briquettes.

The directives of National Green Tribunal in 2015 advises that:

- Every state will provide machines, mechanism and equipments or its cost to the farmers to remove, collect and store straw.
- Steps to be taken by state governments and NCT Delhi to educate and advise farmers through media, gram panchayats and corporations on utilization of agricultural residues—in boards, fodder, rough-paper manufacturing, power generation etc.
- Mechanism for collection of crop residue, transportation and utilization to be evolved and necessary incentivization mechanism may be created for the same.

Punjab Mission on Sustainable Agriculture calls for sustainably management of agriculture crop residue to avoid the ill effects of on farm burning of crop residue in Punjab and also benefit from management of the same. It also calls for promotion of power generation from agricultural residue. Punjab SAPCC aims for promotion of organic Farming- Demonstration of green manuring for improving soil health; vermicomposting, etc.

Rajasthan SAPCC calls for development of Fodder bank so that excess crop residue is stored in structures called Karai or Pachave for adverse years as it provides an important coping mechanism for securing livestock during drought. The SAPCC also emphasizes on the better management of crop residue for power generation.

## 2.6 Component wise technical standards:

Activity	Applicable Standard	Application to project - responsibility
1. Demonstration of crop residue incorporation in soil	Soil health management prescriptions of Government Department and ICAR	Concerned line departments viz. Dept. of Agri.
2. In situ residue management	-- do --	-- do--
3. Custom Hiring Centres	Farm mechanisation standards Guideline of State/Central Govt./ICAR on machinery usages	-- do--
4. Support for appropriate farm machineries at farmers level	-- do --	--do
5. Cropping pattern diversification	Crop management recommendations from Agri Dept. and ICAR	-- do--
6. Fodder collection units	-- do--	--do--
7. Fodder management	-- do--	--do--
8. Biomass power units	Biomass unit industrial standards	PCST and concerned line departments.
9. Briquette making unit	Briquette unit industrial standards	PCST and concerned line departments.
10. Compost making units	Composting techniques as recommended by ICAR	Agri. Dept. of State Government

## 2.7 Duplication Check:



Convergence with the existing programmes of State and Central government would be ensured under project. The possible convergence opportunities exists with organic farming initiatives, farm mechanization programmes as well renewable energy programmes for scaling up and sustainability of initiatives will be identified. To avoid duplication of benefits, the EE will prepare area specific and intervention specific plan with mutual discussion of all stakeholders.

## 2.8 Stakeholders Consultation

During the development of the proposal wide stakeholder consultation at various level were taken-up. Further experiences during implementation of pilot on crop residue management were taken into consideration to understand the constraints are primary stakeholders level and designing of the propose interventions.

Brief account of the deliberations during the meetings are presented in the table below. The proceedings of the meeting are given in the Annexure 3.

Consultation	Date/ Place	Participation	Objective	Outcome
1) Stakeholder consultation	9-10 November 2017 Chandigarh	Civil Society, Farmers Producer Organisations (FPOs), Agri. and Farmer Welfare Department, Technical Institutions, International Universities, Commercial Banks and Entrepreneurs from Punjab and Haryana.	<ul style="list-style-type: none"> <li>To explore technically and socially viable technologies</li> <li>To look at the feasibility of bank finance</li> <li>To demonstrate the impact of successful NRM models addressing the issue Haryana</li> <li>To initiate policy dialogue to improve the adoption of sustainable technologies and finance approach</li> </ul>	<p>Technology recommendation for <i>in situ</i> management</p> <p>Farmers collective as approach for management of crop residue.</p> <p>Technology options for farm mechanization.</p> <p>Accelerating decomposing for paddy straw is a technology challenge.</p> <p>Crop diversification to pulses and millets can also be promoted.</p>

2).Stakeholder consultation for Punjab State	15 November 2017 Chandigarh	State Govt. Departments, Agri. Universities, Research Institutions	Identification of climate change priorities for the state	Crop residue management is an important challenge for appropriate climate action.  Potential exists for paddy straw as a fodder.  Integrated approach required and insitu management is most appropriate option.
3). Stakeholder consultation for finalisation of interventions for Punjab State	14 December 2017 Chandigarh	All line Deptts / SAU/ GADVASU/ NTPC	To finalise interventions and implementation arrangements	Convergence with existing programmes were finalised, Interventions to be supported under NAFCC were identified, Role of Executing Entities were also finalised.
4). Stakeholder consultation for finalisation of interventions for Haryana State	21 December 2017 Chandigarh	All line Depts. of Haryana State	To finalise interventions and implementation arrangements	Convergence with existing programmes were finalised, Interventions to be supported under NAFCC were identified, Role of Executing Entities were also finalised.

## 2.9 Knowledge Management

The knowledge management components under the project include:

- a) Workshops and trainings on the successful interventions for the farmers. The learnings would disseminated through suitable policy briefs and documentations.

- b) The project would include reporting and evaluation mechanism to capture the impact parameters and learnings for the project would be communicated to the concerned stakeholders.
- c) Further, it has been proposed to establish the Regional Bio-Residue Management Technology Facilitation Centre at Chandigarh, which is expected to create necessary framework for capturing the learnings as well as scaling of the same. The centre would also promote documentation of the best practises that would emerge under the project and disseminate the same among the farmers and stakeholders.

**2.10 Sustainability of the project/programme outcomes has been taken into account when designing the project / programme.**

<b>Expected outcomes</b>	<b>Expected concrete outputs</b>	<b>Sustainability mechanism</b>	<b>Responsible party/ies</b>
Soil incorporation of the crop residue	The project villages adoption the soil incorporation of the crop residue.	The farmers would be sensitised on the importance of sustainable management of soil fertility and its importance for crop production and productivity. Farmers collectives would be formed to ensure the adoption of the technology	Executing partners (Department of Agriculture of Respective states and PCST)
Custom Hiring Centres	Entrepreneurship models would be developed under the project	The project would ensure development of financially viable CHC which would be sustainable over the project implementation as well as post implementation. The project support would provide necessary viability gap funding during the initial stage of the implementation of this component	Executing partners (Department of Agriculture of Respective states and PCST)
Crop diversification to ensure sustainable crop management strategies	Crop diversification would be promoted in the project areas to ensure alternative income opportunities.	The selection of alternative cropping pattern would be based on the detailed stakeholders consultations. Further necessary backward and forward linkages would be provided to ensure sustainability.	Executing partners (Department of Agriculture of Respective states and PCST)

Project villages would adopt the necessary mechanism for sustainable fodder management strategies.	Fodder development – promotion of collection storage and transport	The project would provide necessary implementation framework through farmers collectives for promotion of fodder collection, storage and management. The shortage of the fodder in the neighbouring districts and states would ensure continuous demand post project implementation as well	Executing partners (Department of Agriculture of Respective states and PCST)
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### 2.11 overview of the environmental and social impacts and risks identified as being relevant to the project / programme

Checklist of environmental and social principles	No further assessment required for compliance	Potential impacts and risks – further assessment and management required for compliance
Compliance with the Law	nil	The project is in line with the National Policy on Crop Residue Management, Directives of The Central Government , SAPCC of respective states.
Access and Equity	Nil	The project beneficiary selection would include proper equity across gender as well as vulnerable communities. Implementation framework ensures proper access and equity. Project provides fair and equitable access to the project beneficiaries and is based on vulnerability aspects linked to agriculture productivity. During the project implementation at the community level interventions, special focus will be given to women and disadvantaged groups in building their capacities and enabling their access to community level assets (knowledge and natural resources)
Marginalized and Vulnerable Groups	Nil	The project beneficiary selection would include proper equity across gender as well as vulnerable communities
Human Rights	Nil	Necessary measures would be taken up to ensure compliance. Proposed project does not foresee any violation of human rights

Gender Equity and Women's Empowerment	Nil.	Decision making on intervention identification, beneficiary selection would include women participation. Project would ensure equitable participation by women and receive comparable socio-economic benefits so that they do not suffer adverse effect.
Core Labour Rights	Nil	Payments to labour under the project will be made as per Government approved wage rate/norms and hence ensuring core labour rights. Necessary measures would be taken up to ensure compliance.
Indigenous Peoples	Nil	Necessary measures would be taken up to ensure compliance
Involuntary Resettlement	Nil.	Project does not envisage any Involuntary Resettlement
Protection of Natural Habitats	Nil.	Not applicable to the project
Conservation of Biological Diversity	Nil.	Project would not cause any adverse impact on biodiversity values
Climate Change	Nil	Project aims to sustain the income of farmers through sustainable crop management strategies. Project has an important benefit on reducing the Greenhouse Gas emissions through tackling the problem of crop residue burning and contribute in mitigating the challenges of climate change.
Pollution Prevention and Resource Efficiency	Nil.	Project promotes resource efficiency insitu management of crop residue. Further reduces the air pollution from residue burning.
Public Health	Nil	Reduction of air pollution by reducing crop residue burning would promote better public health.
Physical and Cultural Heritage	Nil	No adverse impact on cultural heritage related issues is identified
Lands and Soil Conservation	Nil	The project envisages conserving the soil health, improve its organic matter content thereby better water retention capacity, water it also aims to promote alternate cropping pattern aimed at better soil health, low water consumption, etc.

### **3. Approach and Implementation Arrangements**

The project duration is 3 years and all the proposed interventions will be implemented in time bound manner to achieve desired objectives. All the executing entities will coordinate with local institutions with definite target and outcomes. A broad approach of various interventions has been prepared which will act as a guiding tool for the executing entities. The various approaches proposed for various interventions are as under ;

#### **Approach 1. Awareness Creation among Farmers/Stakeholders :**

The following timeline is proposed for awareness creation ;

Stakeholder consultations involving all EEs/Sub executing Entities to finalise content and role of stakeholders ( January/February 2018)

I

Engagement of Professional agency and content Development & Discussion with Partners (PRIs/Gram Sabha/PACs/Dairy Cooperatives/FPOs/APMCs) for finalisation of awareness plan ( by 31 March 2018 )

I

Launching of Awareness Campaign in Ist week of April 2018 upto September 2018 (Various mode like community radios/local TV/Posters/Meetings/etc will be used for awareness workshops)

I

Documentation of feedback of various stakeholders

I

**Outcome – a). Increased awareness among farmers on crop residue management, b) Preparation of districtwise implementable plan**

**Approach 2. – Implementation of alternative uses of Crop Residues and their implementation strategies are highlighted under.**

#### **Alternative 1. In Situ Management of Crop Residue (Incorporation of Paddy Straw into soil & use of happy seeder)**

Demonstration of various machineries on farmer's field for incorporation of paddy straw into soil/use of happy seeder in all districts in the year 2018

I

Consultation with farmers at various forum such as Gram Sabha/PACS/ FPOs for alternative I during April to Sept 2018 and preparation of implementation plan for agreed farmers (either incorporation into soil or use of happy seeder).

I

More coverage of Area in Kharif 2019 & Kharif 2020 under alternative 1.

I

**Outcome – a). Saving in fertiliser cost, b) Improved soil texture & structure and c). Enhanced soil fertility & Soil organic carbon**

**Research Studies on in-situ incorporation :** According to a study by Sidhu and Beri (2005), the best alternative available to burning of rice residue is in-situ incorporation. The results of a 6-year study period showed that if the rice residue is incorporated in the soil 10, 20 or 40 days before sowing the wheat crop, then the productivity of the subsequent wheat and rice crops is not adversely affected. Paddy straw incorporated in wheat did not show a residual effect on the succeeding rice crop. Several reports show similar rice and wheat yields under different residual management practices such as burning, removal, or incorporation (Walia et al. 1995; Singh et al. 1996, Singh and Singh 2001). Singh et al. (1996) reported that the incorporation of paddy straw 3 weeks before sowing significantly increased wheat yield on clay loam soil but not on sandy loam soil. Studies conducted by Sharma et al. (1985, 1987) showed no adverse effect of straw incorporation on the grain yield of wheat and the following rice. As per a study by Singh et al. (1996), the incorporation of rice residue 3 weeks before sowing the wheat crop actually increased the wheat yield only on clay loam soil and not on sandy loam soil. This study further shows that incorporation of crop residues, increased organic carbon by 14–29 %. Furthermore the incorporation of rice stubble in the soil has favorable impact on the soil's physical, chemical and biological properties such as pH, organic carbon, water holding capacity and bulk density of the soil.

### **Alternative 2. Setting up of Custom Hiring Centres**

Identification of ongoing Multi Service Centre at PACs level/FPOs level, etc. in all the districts and availability of various machineries (by April 2018)

I

Estimation of requirement of various machineries and preparation of physical & financial plan for each Custom Hiring Centres (May 2018)

I

Designing of selection criteria of beneficiaries and nature of assistance (by May 2018)

I

Implementation of scheme from Ist May 2018 and onwards on continuous basis (i.e. upto the utilisation of approved financial support)

I

**Outcome – CHCs can be used for Insitu Management, Ex Situ Management of straw with larger coverage of areas.**

### **Alternative 3. Setting up of Fodder Banks**

Consultations at Block/Regional level for setting up of fodder banks (Before March 2018)

I

Identification of promoter of fodder banks (may be PACS/Dairy Cooperative Societies/ WUAs/ Farmers Club/CSOs/)- Before April 2018

I

Identification of Villages for setting up of fodder banks

I

Finalisation of Implementation plan with Promoters of Fodder Banks (June 2018)

I

**Outcome – Setting up of fodder banks in drought prone areas and timely availability of fodder and increased income in surplus area due to sale of crop residue (particularly of straw)**

### **Approach 3. Diversification of Cropping pattern**

Identification of Clusters by Agril Deptt (15 April 2018) – Various consultations with FPOs/PACs/Farmers Club will help in identification of clusters (Existing area having other than paddy cultivation in kharif will not be considered for cluster promotion)- Consultation with NAFED for procurement of produce will help in finalisation of cropping plan

I

Finalisation of Cropping pattern with the Support of Technical institutes like SAUs or ICAR institutes by 15 May 2018 and Capacity building of each cluster on Package of Practices by 15 May 2018.

I

Regular monitoring of cluster and documentation of activities  
( Upto marketing of crop)

I

Exposure visits of clusters to successful FPOs/small processing units(between May to September 2018) & Interface with possible buyers for value addition

I

**Outcome – Changed cropping pattern in Kharif season and enhanced income of farmers**



### **3.1. Implementation arrangements of the Proposal**

The following arrangements are proposed for effective implementation and monitoring of projects at National and State level;

#### **National Steering Committee on Climate Change (NSCCC)**

Review of progress on quarterly basis/ May advise the States to re allocation of slow moving interventions

I

#### **NABARD ( NIE)**

Awareness creation among Farmers/Rural Stakeholders - Monitoring, review and MIS to NSCCC/MoEF&CC/Monitoring of implementation arrangements at State level/ Release of fund to executing entities as per proposed plan

I

#### **State Level Steering Committee on Climate Change (of concerned State)**

- Review of progress on quarterly basis/ Ensure timely implementation of interventions/To ensure equitable utilisation of financial resources through designing proper guidelines/ criterion, etc.

I

#### **Nodal Deptt.**

- Convening of SLSCCC and reporting of progress /Coordination with major executing Entities and Sub executing entities/Organising of inception workshops/ Capacity building programmes or other interventions proposed in the proposal

I

#### **Major Executing Entities ( Agril Deptt of Concerned State)**

- Submission of Half yearly action plan(on monthwise basis) to NIE(through Nodal deptt.)/Submission of monitoring framework and reporting system/Designing of selection criteria for various stakeholders before implementation for equitable distribution of financial resources including gender/Implementation of major interventions proposed in the proposal/ Coordination with sub executing entities in related activities for achieving time bound results

I

### **Sub Executing Entities**

- All other executing entities which are having lesser component of interventions may design their implementation plan with major executing entities, Nodal Deptts and NIE

#### **3.1.1 Implementation arrangements for the state of Punjab:**

The project is proposed to be steered by Management Committee headed by Member Secretary-PSCST, with members major executing entity (Dept. of Agriculture, Govt of Punjab), National Bank for Agriculture and Rural Development (NABARD)-Punjab Regional Officer, PSCST, Guru Angad Dev Veterinary and Animal Sciences University (GADVASU), Punjab Agricultural University (PAU), Animal Husbandry Department (AHD), Punjab Energy Development Agency (PEDA), Dairy Development Department and GIZ (for technical support).

Agency/committee	Responsibility
Project Steering Committee	A project steering committee headed by the Chief Secretary, Govt of Punjab will monitor the overall implementation of projects on quarterly basis. Members will be drawn from other line departments, PAU and GADVASU.
Dept.. of Agriculture, Govt of Punjab	Dept. of Agriculture will be the main implementing entity and major interventions like Incorporation of Straw into soil (demonstrations in 50000 ha as well as incorporation in 500000 ha), setting up of custom hiring units, diversification of cropping pattern will be implemented and necessary support in awareness and capacity building will be provided.
PSCST (Punjab State Council for Science and Technology)	PSCST will be responsible for the following tasks: Overall coordination and review of project in Punjab State. Monitoring the project outcomes and outputs. Preparing progress report of the project for the steering committee meetings that will happen quarterly.
AHD (Animal Husbandry Department) / Guru Angad Dev Veterinary and Animal Sciences University (GADVASU)	AHD (Animal Husbandry Department) and GADVASU will be responsible for proposed interventions on fodder development and setting up of 50 units.
PAU (Punjab Agricultural University)	PAU will be responsible for technical support

#### **3.1.2 Implementation arrangements for the state of Haryana:**

The interventions in the Haryana would be coordinated by the Dept. of Agriculture in coordination with the Nodal Department. The technical support for the project would be provided by the department as well as State Agriculture University.

### 3.1.3. Implementation arrangements for the state of Rajasthan

The interventions in the Rajasthan would be coordinated by the Dept. of Agriculture in coordination with the Nodal Department. The other execution partners would include farmers collective, cooperative, PACs, Department of AH, State Milk Cooperative Federation.

### 3.1.4. Implementation arrangements for the state of Uttar Pradesh

The interventions in the Uttar Pradesh State would be coordinated by the Nodal Deptt/ Uttar Pradesh Bioenergy Development Board Lucknow in coordination with the other line Deptts. The other execution partners would include farmers collective, cooperative, PACs, Department of AH/ State Milk Cooperative Federation, etc.

### 3.2 Describe the measures for financial and project / programme risk management (also include environmental and social risk, if any).

Risk	Rating (High / Medium / Low, etc.)	Mitigation Measure
Farmers might not agree to shift to cropping system	Medium	Farmers will be sensitized about the possible benefits they would get after implementation of activities Farmers would also be trained providing details of the project implementation
Selection of target beneficiaries	Medium	A comprehensive criteria list for selecting target beneficiaries will be developed. Farmers, who would meet the criteria, would be selected as target beneficiaries under the project.
Activities may not result the expected outcome as planned for soil incorporation and in situ management	Low	Project beneficiaries would be sensitised on the importance of in situ management. Project implementation would be guided by necessary monitoring and review structure.

### **3.3 Monitoring and evaluation arrangements.**

Reporting mechanism: In the inception workshop of the project, a set of monitoring and evaluation parameters and reporting format and procedures will be developed with the stakeholders. Quarterly report will be produced for internal monitoring and evaluation. Project level review and plan meetings will be organised on a half yearly basis in which project stakeholders, implementing partners will participate. This meeting will serve the purpose of reviewing and improvising the plans and also building common understanding and capacity building purposes. A mechanism of bringing out publications and reports of individual events will be put in place for concurrent documentation and sharing.

### **3.4 Result Framework**

Presented in the Annexure 1

### **3.5 Budget Notes**

Budget notes are provided in the Annexure 2

## Annexure 1

### Result Framework

Outcome/Output	Indicator	Baseline	Target	Source of Verification	Risks and Assumptions
Outcome 1: Soil incorporation of the crop residue	Improvement in the capacity related to on-farm soil moisture conservation, varietal selection and improved crop production practices	Current practices and soil and moisture conditions, productivity will be assessed before implementation of the project	Total 90,500 ha area of Punjab, Haryana and Uttar Pradesh state would be covered for demonstration	List of participating farmers and periodical reports Data collected in the mid-term of the project and by the end of the project	<ul style="list-style-type: none"> <li>• <b>Adoption of technology by farmers</b></li> <li>• <b>Farmer's participation in the training programme</b></li> </ul>
Output 1.1: Demonstration for Soil incorporation of the crop residue					
Output 1.2 : Incorporation of crop residue in soil					
Outcome 2: Ensuring effective mechanism for crop residue management in project areas	No. of CHCs establishments	Assessment of Already existing units	Total 900 Custom Hiring Centres will be established	Data collected in the mid-term of the project and by the end of the project	Earnings from the centres depends upon market mechanism
Output 1 : Setting up of Custom Hiring Centres					

<b>Outcome/Output</b>	<b>Indicator</b>	<b>Baseline</b>	<b>Target</b>	<b>Source of Verification</b>	<b>Risks and Assumptions</b>
Output 2: Mechanization at farmers level	machineries at farmers level		machineries unit purchase will be supported		
<p>Outcome 3: Reduction in crop residue burning in the region by technological interventions</p> <p>Output 3.1: Est. of Regional Bio-Residue Management Technology Facilitation Centre</p> <p>Output 3.2: Est. of Briquette making units</p> <p>Output 3.3: Setting up of Biomass based power plant at local level by local entrepreneurs/ local societies/CSOs (using cow dung and paddy straw or</p>	Pollution level during the crop harvesting season	Historical pollution level data	<p>1 Regional Bio-Residue Management Technology Facilitation Centre will be established in Punjab</p> <p>100 Briquette making units will be supported in Haryana</p> <p>100 Biomass based power plant will be established</p>	Comparison with historical pollution data in the region released by monitoring agencies	Data collection and reporting

<b>Outcome/Output</b>	<b>Indicator</b>	<b>Baseline</b>	<b>Target</b>	<b>Source of Verification</b>	<b>Risks and Assumptions</b>
other locally available bio mass)					
<p><b>Outcome 3: Crop diversification in the region</b></p> <p>Output 3.1: increased in area to be covered under crop diversification from khraif 2018</p> <p>Output 3.2: Setting up of Pulse processing unit / cluster</p> <p>Output 3.3: Exposure visits of farmers</p>	Area covered under different cropping patterns	Baseline survey of the region	<p>Target area to be covered under crop diversification is 11,000 ha in kharif season of 2018</p> <p>40 Pulse processing unit / cluster will be established</p> <p>60 Exposure visits of farmers</p>	Data collected in the mid-term of the project and by the end of the project	It is assumed that the farmers would accept the crop diversification models and would provide better profits.

<b>Outcome/Output</b>	<b>Indicator</b>	<b>Baseline</b>	<b>Target</b>	<b>Source of Verification</b>	<b>Risks and Assumptions</b>
<p>Outcome 4: Transform the residue into fodder</p> <p>Output 4.1: Setting up of fodder bank in Rajasthan</p> <p>Output 4.2: Est. of Fodder Development/collection Units for JLGs/FPOs/ Farmers Club</p>	Number of units	The status in the beginning of the project would be documented	<p>500 fodder bank will be established in Rajasthan</p> <p>100 fodder development/collection unit will be established in Punjab and Haryana state</p>	Report of the initiative taken and physical units	<p>Land acquisition</p> <p>Political consensus for establishment of unit in area</p> <p>Interest of farmers to adopt the intervention</p>
Output 5: Promotional expenses such as identification of PACS/FPOs/ CHCs and finalisation of manufacturers and selection criteria for eligibility			3050 PACS/FPOs/ CHCs to be identified	Progress Reporting	All the farmers collective express willingness to work in these areas



<b>Outcome/Output</b>	<b>Indicator</b>	<b>Baseline</b>	<b>Target</b>	<b>Source of Verification</b>	<b>Risks and Assumptions</b>
<p>Output 6: Awareness and Capacity Building Programmes</p> <p>Output 6.1: Establishment of Units for Demonstration/ Urea treatment/ Fodder Blocks/ Exposure visits/ Interface with Surplus and Deficit areas</p> <p>Output 6.2: Awareness programmes at village level</p> <p>Output 6.3: Workshops at district and regional level</p>	Number of villages/stakeholders reached/informed	The status in the beginning of the project would be documented	<p>50 Demonstration/ Urea treatment/ Fodder Blocks/ Exposure visits/ Interface with Surplus and Deficit areas will be established</p> <p>Awareness and capacity building programmes will be organised in 16,600 villages</p> <p>37 district level workshops for CH owners</p> <p>10 stakeholder workshops for biomass based units will be</p>	List of workshop in villages and no. of participants	The policy makers and other stakeholders will be receptive for the recommendations

Outcome/Output	Indicator	Baseline	Target	Source of Verification	Risks and Assumptions
			organised 25 Exposure activities will be organised 800 Demo units of compost making will be established		

## Annexure 2

### Budget Notes:

The State wise budget details of proposal are as under:

#### 1. Punjab

S r. N o.	Interventions proposed	Proposed area (in Ha.)	Rate /ha as Grant to EE( Rs.)	Propo sed Invest ment by Benefic iaries	Total Invest ment	Total NAFCC Support Propose d (Rs.)
1	<b>Incorporation of Straw into soil ( Demonstrations)- Kharif 2018 (Part of Capacity Building programmes of Farmers)</b>					29823350 00
	A) Using of Rotavator/reaper, mulcher for incorporation @ 25 ha in 1000 villages	23000	2500	1380000 00	195500 000	57500000
	B). Use of Happy Seeder in 25 Ha in 1000 villages	23000	2000	1380000 00	184000 000	46000000
	C). In situ Composting with Bio Waste Decomposer (1000 Ha) in 500 villages	1000	2500	600000 0	85000 00	2500000
	d). Soil Testing/ Yield recording of above interventions on sample basis (10% of area)	5000	750	Nil	375000 0	3750000
	e). Promotional expenses for identification of areas of demonstrations, mobilisation of farmers, engagement of concerned agencies, tie up with CHCs, etc.(i.e. @ Rs.100 per ha)	47000	250	Nil	117500 00	11750000
2	<b>Incorporation of crop residue in 500000 ha - Kharif 2018 (Major Interventions)</b>	500000	2500	300000 0000	425000 0000	12500000 00
	<b>Sub Total</b>	<b>51000</b>				

S r. N o.	Interventions proposed	Proposed area (in Ha.)	Rate /ha as Grant to EE( Rs.)	Propo sed Invest ment by Benefi ciaries	Total Invest ment	Total NAFCC Support Propose d (Rs.)
3	Setting up of Custom Hiring Units with Zero till, laser landleveller, mulcher, baler, (Including strengthening of existing CHCs) through bank loan ( Rate of subsidy may vary and be given as per viability of units) - Advance fund of subsidy will be parked so bank will come forward for loan/ Back ended subsidy would help in non disposing of assets by beneficiaries/ Existing custom hiring models can be studied and VGF support can be thought of accordingly. ( Note - existing custom hiring units may be studied and guidelines for supporting these units may be finalised before 31 March 2018 by hiring a suitable agency)	300 Units (Preference may be given to PACS which are working as multi Service centre/ FPOs/ Existing Custom hiring units with add on required machineries / State Govt may consider inviting bid for supply of equipments to these units so that machinery rate will be uniform.	250000 0	250000 0 (40% bank loan can be availed by beneficia ries)	150000 0000	75000000 0
4	Small machineries like happy seeder/ mulcher/ land leveller to individuals through Bank Loan	1000 units	200000	200000 000	20000 0000	10000000 0
5	Promotional expenses such as identification of PACS/FPOs/ CHCs and finalisation of manufacturers and selection criteria for eligibility.	1300 Units (group & Individuals)	1000	1300000	130000 0	1300000
	<b>Sub Total</b>					
6	<b>Diversification of Cropping pattern on Pilot Basis</b>					
	a) Proposed area					
	- Kharif 2018 ( June to October 2018) - 5 clusters of 200 ha each	1000	Rs.2350 0/ha	2175000 00	28800 0000	70500000
	- Kharif 2019 ( June to 2018) - 20 clusters of 200 ha each	4000	Rs.2350 0/ha	870000 000	115200 0000	28200000 0

Sr. No.	Interventions proposed	Proposed area (in Ha.)	Rate /ha as Grant to EE( Rs.)	Proposed Investment by Beneficiaries	Total Investment	Total NAFCC Support Proposed (Rs.)
	Promotional cost of promoters of clusters in Kharif 2018 & 2019 @ Rs.3000/ha for 3 yrs.	5000	3000		15000000	15000000
	Pulse processing unit / cluster (Machinery with capacity of 2 tonne/day are available can be set up by cluster/FPOs/PACs in cluster	25 units	Rs.750000 per unit	50% of Promoter (Bank loan can be taken up as advance subsidy under NAFCC can be provided )	18750000	93750000
	Exposure visit of farmers to such processing units	25 Visits	Rs 100000 /visit	Nil	2500000	2500000
	Interface with Corporates for marketing tie up	2 Interface	Rs.50000/interf ace	nil	100000	100000
	<b>Sub Total</b>					
5	Fodder Development/collection Units for JLGs/FPOs/ Farmers Club	50 units	Rs 16.8 lakh (One ha collection unit)	50% on Baler or other related machine ries (Bank loan may be involved )	8400000	42000000
6	Promotional cost of 50 Units (Demonstration/ Urea treatment/ Fodder Blocks/ Exposure visits/ Interface with Surplus and Deficit areas)	Programmes & Visits	@ 5% of Intervention	Nil		4200000
	<b>Sub Total</b>					
7	<b>Awareness and Capacity Building of Farmers</b>					
	•Awareness programmes- (Farmers/PRI/ CH owners/ Rural Entrepreneur)	In 12000 Villages	Rs.5000 / Village	Nil	6000000	6000000
	•Workshop of stakeholders (Bio mass based units)	4	Rs.1 lakh/W orkshop	Nil	400000	400000

S r. N o.	Interventions proposed	Proposed area (in Ha.)	Rate /ha as Grant to EE( Rs.)	Proposed Investment by Beneficiaries	Total Investment	Total NAFCC Support Proposed (Rs.)
	•District Level workshops of CH Owners	22	Rs.25000/works hop	Nil	550000	550000
	•Regional workshops for PACs working as MSC/ FPOs	10	Rs 50000/ Worksh op	Nil	500000	500000
	•Exposure visits to potential areas/activities	10	100000 /visit		1000000	1000000
	•Demo unit of Compost making/CBP of farmers/district	500	25000/ unit		12500000	12500000
	• Feedback of above workshops and finalisation of Selection criteria & financial support for concrete interventions				5000000	5000000
	•Identification of end use of straw and tie up plan				500000	500000
	Sub Total					
8	Regional Bio-Residue Management Technology Facilitation Centre				19091000	19091000
9	Setting up of Biomass based power plant at local level by local entrepreneurs/ local societies/CSOs (using cow dung and paddy straw or other locally available bio mass)	50	2500000	6250000	12500000	62500000
	Total NAFCC Support in 3 Years (for Punjab State)				8311510000	2982335000
	Project Management Charges @ 3%	0.00	0.00			89470050.00
	Total Project Implementation Cost	0.00	0.00			<b>3071805050.00</b>
	NIE fees @ 3%	0.00	0.00			92154151.50
					Total	<b>3163959201.50</b>
Concrete Intervention Activities						2676125000.00
Capacity Building Activities						306210000.00
Management related activities						181624201.50

## 2. Haryana

Sl no.	Interventions proposed	Proposed area (in Ha.)	Rate /ha as Grant to EE( Rs.)	Proposed Investment by Beneficiaries	Total Investment	Total NAFCC Support Proposed (Rs.)
1	<p>Setting up of Custom Hiring Units (Including strengthening of existing CHCs) through bank loan ( Rate of subsidy may vary and be given as per viability of units) - Advance fund of subsidy will be parked so bank will come forward for loan/ Back ended subsidy would help in non-disposing of assets by beneficiaries/ Existing custom hiring models can be studied and VGF support can be thought of accordingly. ( Note - existing custom hiring units may be studied and guidelines for supporting these units may be finalised before 31 March 2018 by hiring a suitable agency)</p> <p>(Preference may be given to PACS which are working as multi Service centre/ FPOs/ Existing Custom hiring units with add on required machineries/ State Govt may consider inviting bid for supply of equipments to these units so that machinery rate will be uniform)</p>	500 Units	2500000	62500000	12500000	62500000
2	Small machineries like happy seeder/ mulcher/ land leveller to individuals through Bank Loan	1000	200000	10000000	2000000	10000000
3	Promotional expenses such as identification of PACS/FPOs/ CHCs and finalisation of manufacturers and selection criteria for	1500 Units (group & Individuals)	1000		1500000	1500000

Sl no.	Interventions proposed	Proposed area (in Ha.)	Rate /ha as Grant to EE( Rs.)	Proposed Investment by Beneficiaries	Total Investment	Total NAFCC Support Proposed (Rs.)
	eligibility.					
4	<b>Incorporation of Straw into soil ( Demonstrations)- Kharif 2018 (Part of Capacity Building programmes of Farmers)</b>					
	A) Using of Rotavator/reaper, mulcher for incorporation @ 25 ha in 1000 villages	12000	2500	72000000	102000000	30000000
	B). Use of Happy Seeder in 25 Ha in 1000 villages	12000	2000	72000000	96000000	24000000
	C). In situ Composting with Bio Waste Decomposer (1000 Ha) in 500 villages	1000	2500	6000000	8500000	2500000
	d). Soil Testing/ Yield recording of above interventions on sample basis (10% of area)	2500	750	Nil	1875000	1875000
5	<b>Incorporation of crop residue in 200000 ha - Kharif 2018 (Major Interventions)</b>	200000	2500	1200000000	1700000000	500000000
	<b>Sub Total</b>					
6	<b>Diversification of Cropping pattern on Pilot Basis</b>					
	a) Proposed area					
	- Kharif 2018 ( June to October 2018) - 10 clusters of 200 ha each	3000	Rs.23500/ha	65250000	864000000	211500000
	Promotional cost of promoters of clusters in Kharif 2018 @ Rs.3000/ha for 3 yrs.	3000 ha	Rs.3000/ha for 3 years			9000000



Sl no.	Interventions proposed	Proposed area (in Ha.)	Rate /ha as Grant to EE( Rs.)	Proposed Investment by Beneficiaries	Total Investment	Total NAFCC Support Proposed (Rs.)
	Pulse processing unit / cluster (Machinery with capacity of 2 tonne/day are available can be set up by cluster/FPOs/PACs in cluster)	15 units	Rs.750000 per unit	50% of Promoter (Bank loan can be taken up as advance subsidy under NAFCC can be provided)		3750000
	Exposure visit of farmers to such processing units	15 Visits	Rs 100000/visit	Nil		1000000
	Interface with Corporates for marketing tie up	2 Interface	Rs.50000/interface	nil		100000
5	Fodder Development/collection Units for JLGs/FPOs	50 units	Rs 16.8 lakh (One ha collection unit)	50% on Baler or other related machineries (Bank loan may be involved)	84000000	42000000
6	Promotional cost of 50 Units (Demonstration/ Urea treatment/ Fodder Blocks/ Exposure visits/ Interface with Surplus and Deficit areas)	Programmes & Visits	@ 5% of Intervention	Nil		4200000
7	<b>Awareness and Capacity Building of Farmers</b>					
	•Awareness programmes- (Farmers/PRI/ CH owners/ Rural Entrepreneur)	3500	Rs.5000/ Village	Nil		17500000

Sl no.	Interventions proposed	Proposed area (in Ha.)	Rate /ha as Grant to EE( Rs.)	Proposed Investment by Beneficiaries	Total Investment	Total NAFCC Support Proposed (Rs.)
	•Workshop of stakeholders (Bio mass based units )	2	Rs.1 lakh/Workshop	Nil		200000
	•District Level workshops of CH Owners	10	Rs.25000/works hop	Nil		250000
	•Regional workshops for PACs working as MSC/ FPOs	5	Rs 50000/Worksho p	Nil		250000
	•Exposure visits to potential areas/activities	5	100000/visit			500000
	•Demo unit of Compost making/CBP of farmers/district	250	25000/unit			625000
	• Feedback of above workshops and finalisation of Selection criteria & financial support for concrete interventions					500000
	•Identification of end use of straw and tie up plan					500000
	Sub Total					
8	Briquette making units	100	2500000	125000000	250000000	125000000
9	Setting up of Biomass based power plant at local level by local entrepreneurs/ local societies/CSOs (using cow dung and paddy straw or other locally available bio mass)	50	2500000	6250000	12500000	6250000
	Total NAFCC Support in 3 Years (for Haryana State)				4682875000	1774375000
	Project Management Charges @ 3%	0.00	0.00			53231250.00
	Total Project Implementation Cost	0.00	0.00			<b>1827606250.00</b>
	NIE fees @ 3%	0.00	0.00			54828187.50

Sl no.	Interventions proposed	Proposed area (in Ha.)	Rate /ha as Grant to EE( Rs.)	Proposed Investment by Beneficiaries	Total Investment	Total NAFCC Support Proposed (Rs.)
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Total **188243  
4437.5  
0**

Concrete Intervention Activities						1601250 000.00
Capacity Building Activities						1731250 00.00
Management related activities						1080594 37.50

### 3. Rajasthan

Sr. No.	Interventions proposed	Proposed area (in Ha.)	Rate /ha as Grant to EE( Rs.)	Proposed Investment by Beneficiaries	Total Investment	Total NAFCC Support Proposed (Rs.)
1	<p>Setting up of Custom Hiring Units (Including strengthening of existing CHCs) through bank loan ( Rate of subsidy may vary and be given as per viability of units) - Advance fund of subsidy will be parked so bank will come forward for loan/ Back ended subsidy would help in non disposing of assets by beneficiaries/ Existing custom hiring models can be studied and VGF support can be thought of accordingly. ( Note - existing custom hiring units may be studied and guidelines for supporting these units may be finalised before 31 March 2018 by hiring a suitable agency)</p> <p>(Preference may be given to PACS which are working as multi Service centre/ FPOs/ Existing Custom</p>	50 Units	2500000	62500000	125000000	62500000

<b>S r. N o .</b>	<b>Interventions proposed</b>	<b>Prop osed area (in Ha.)</b>	<b>Rate /ha as Grant to EE( Rs.)</b>	<b>Propo sed Invest ment by Benefi ciaries</b>	<b>Total Inves tmen t</b>	<b>Total NAFCC Suppor t Propos ed (Rs.)</b>
	hiring units with add on required machineries/ State Govt may consider inviting bid for supply of equipments to these units so that machinery rate will be uniform.					
<b>2</b>	Small machineries like happy seeder/ mulcher/ land leveller to individuals through Bank Loan	100	200000	10000 000	2000 0000	100000 00
<b>3</b>	Promotional expenses such as identification of PACS/FPOs/ CHCs and finalisation of manufacturers and selection criteria for eligibility.	150 Units (grou p & Indivi duals)	1000		15000 0	150000
<b>4</b>	<b>Setting up of Fodder Banks</b>					
	a). No of Fodder Banks (in Churu, Bikaner, Nagore, Jaisalmer & Barmer districts)	500	40000	nil	6000 0000	600000 00
	b). Promotional Charges per fodder Bank to promoters for 3 Years (Rs. 7500/Fodder Bank)	500	7500	nil	37500 00	375000 0
	c). Transportation Charges to fodder banks through DCS/ CSOs/FPOs/PACS/FCs (Rs.1 lakh for 3 years with minimum storage of 1000 tonne) & transportation charges may be rationalised on distance wise basis.	500	100000	Other transpo rtation charges will be borne by Benefic iaries	50000 000	500000 00
	d). Training for fodder quality improvement and maintenance of dairy	50	100000		50000 00	500000 0

S r. N o.	Interventions proposed	Prop osed area (in Ha.)	Rate /ha as Grant to EE( Rs.)	Propo sed Invest ment by Benefi ciaries	Total Inves tmen t	Total NAFCC Suppor t Propos ed (Rs.)
	animals					
5	•Awareness programmes- (Farmers/PRIIs/ FCs)	1000	Rs.5000/ Village	Nil		500000 0
	•Regional workshops for PACs/FPOs/FCs	5	Rs 50000/W orkshop	Nil		250000
	• Feedback of above workshops and finalisation of Selection criteria & financial support for concrete interventions					100000 0
	Total NAFCC Support in 3 Years ( for Rajasthan State)				26390 0000	1976500 00
	Project Management Charges @ 3%	0.00	0.00			592950 0.00
	Total Project Implementation Cost	0.00	0.00			<b>203579 500.00</b>
	NIE fees @ 3%	0.00	0.00			6107385 .00
					Total	<b>20968 6885.0 0</b>

Concrete Intervention Activities						186250 000.00
Capacity Building Activities						1140000 0.00
Management related activities						120368 85.00

#### 4) Uttar Pradesh

Sr. No.	Interventions proposed	Proposed area (in Ha.)	Rate /ha as Grant to EE( Rs.)	Proposed Investment by Beneficiaries	Rate /ha as Beneficiaries ( Rs.)	Total Investment	Rate /ha as total Investment to EE( Rs.)	Total NAFCC Support Proposed (Rs.)
1	Incorporation of Straw into soil ( Demonstrations)- Kharif 2018 (Part of Capacity Building programmes of Farmers) - demo component							
	A) Using of Rotavator/rea per, mulcher for incorporation @ 50 ha in 100 villages	5000	2500	300000 00	6000	425000 00	8500	125000 00
	B). Use of Happy Seeder in 50 Ha in 100 villages	5000	2000	300000 00	6000	40000 000	8000	100000 00
	C). In situ Composting with Bio Waste Decomposer (1000 Ha) in 100 villages	1000	2500	600000 0	6000	85000 00	8500	250000 0
	d). Soil Testing/ Yield recording of above interventions on sample basis (10% of area)	500	750	0		375000	750	375000
	e). Promotional expenses for identification of areas of demonstrations, mobilisation of farmers, engagement of concerned	11000	250	0		275000 0	250	275000 0

	agencies, tie up with CHCs, etc.(i.e. @ Rs.100 per ha)							
2	Incorporation of crop residue in 10000 ha - Kharif 2018 (Major Interventions)	10000	2500	600000 00	6000	85000 000	8500	250000 00
3	Setting up of Custom Hiring Units with Zero till, laser landleveller, mulcher,baler , (Including strengthening of existing CHCs) through bank loan ( Rate of subsidy may vary and be given as per viability of units) - Advance fund of subsidy will be parked so bank will come forward for loan/ Back ended subsidy would help in non disposing of assets by beneficiaries/ Existing custom hiring models can be studied and VGF support can be thought of accordingly. ( Note - existing custom hiring units may be studied and guidelines for supporting these units may be finalised before 31 March 2018	50	2500 000	625000 00		125000 000		625000 00

	by hiring a suitable agency) - Units (Preference may be given to PACS which are working as multi Service centre/ FPOs/ Existing Custom hiring units with add on required machineries/ State Govt may consider inviting bid for supply of equipments to these units so that machinery rate will be uniform.							
4	Small machineries like happy seader/ mulcher/ land leveller to individuals through Bank Loan	20	2000 00	200000 000		20000 0000		100000 000
5	Promotional expenses such as identification of PACS/FPOs/ CHCs and finalisation of manufacturers and selection criteria for eligibility.	100	1000	1300000		130000 0		130000 0
	Sub Total							
6	Diversification of Cropping pattern on Pilot Basis							
	a) Proposed area							
	- Kharif 2018 ( June to October 2018) - 5 clusters of 200 ha each	0	0	0		0		



	- Kharif 2019 ( June to 2018) - 20 clusters of 200 ha each	0	0	0		0		
	Promotional cost of promoters of clusters in Kharif 2018 & 2019 @ Rs.3000/ha for 3 yrs.	0	0	0		0		
	Pulse processing unit / cluster ( Machinery with capacity of 2 tonne/day are available can be set up by cluster/FPOs/PACs in cluster	0	0	0		0		
	Exposure visit of farmers to such processing units	20	100000	0		200000		2000000
	Interface with Corporates for marketing tie up	2	50000	0		100000		100000
	Sub Total							
5	Fodder Development/ collection Units for JLGs/FPOs/ Farmers Club	0	0	0		0		
6	Promotional cost of 50 Units (Demonstration/ Urea treatment/ Fodder Blocks/ Exposure visits/ Interface with Surplus and Deficit areas)	0	0	0				0
	Sub Total							
7	Awareness and Capacity Building of Farmers							

	•Awareness programmes-(Farmers/PRI s/ CH owners/ Rural Entrepreneur) in villages	100	5000	0		50000 0		500000
	•Workshop of stakeholders (Bio mass based units )	4	1000 00	0		40000 0		400000
	•District Level workshops of CH Owners	5	2500 0	0		125000		125000
	•Regional workshops for PACs working as MSC/ FPOs	5	5000 0	0		25000 0		250000
	•Exposure visits to potential areas/activities	10	1000 00	0		100000 0		100000 0
	•Demo unit of Compost making/CBP of farmers/district	50	2500 0	0		125000 0		125000 0
	• Feedback of above workshops and finalisation of Selection criteria & financial support for concrete interventions					100000 0		100000 0
	•Identification of end use of straw and tie up plan					50000 0		500000
8	Regional Bio-Residue Management Technology Facilitation Centre							
9	Setting up of Biomass based power plant at local level by local entrepreneurs / local societies/CSOs (using cow							0

	dung and paddy straw or other locally available bio mass)							
	Total NAFCC Support in 3 Years ( for Punjab State)			389800 000		512550 000		224050 000
	Project Management Charges @ 3%	0.00	0.00					6721500 .00
	Total Project Implementation Cost	0.00	0.00					2307715 00.00
	NIE fees @ 3%	0.00	0.00					6923145 .00
							Total	2376946 45.00
	Concrete Intervention Activities							2128750 00.00
	Capacity Building Activities							1117500 0.00
	Management related activities							1364464 5.00

### **Annexure 3**

#### **Details on Stake-holder consultation – Proceedings of meeting:**

Brief deliberations and outcomes of important stakeholders consultation meetings are given below:

##### **1) Stakeholders Consultation – 14 December 2017**

(Meeting with Development Commissioner, Govt of Punjab)

A detailed deliberation on the proposed NAFCC project with Shri Biswajeet Khanna, IAS, Additional Chief Secretary (ACS), Development, Govt of Punjab was held at 10 AM on 14 December 2017 and the following points were discussed. While initiating the discussion, ACS, Development, Govt of Punjab highlighted the following points ;

- ✓ Awareness among farmers for building soil health and input saving is being created.
- ✓ Large size of crop residue (> 15 mt) needs to be tackled.
- ✓ Collection time of crop residue before next sowing is less than 20 days and short duration varieties are being promoted.
- ✓ In –situ management is best solution which requires fast techniques for decomposition and more water.
- ✓ Action plan for crop residue management should have machineries, diversification of cropping pattern and awareness components.
- ✓ Diversification incentive for farmers may be thought of in the action plan.

##### **2) Stakeholders’ Consultation Meet On Crop Residue Management In Punjab (14<sup>th</sup> December 2017)**

A Stakeholder Consultation Meet on Crop residue Management was held on December 14th, 2017, in NABARD, Punjab Regional Office, Chandigarh. The



Meet started with a welcome address by Shri Deepak Kumar, CGM, NABARD, Punjab RO, where he elaborated the theme of the Meet. The Meet received widespread participation and was attended by seniors officials from the state government departments as well as representatives from the user industries (power sector) , scientists from GADVASU,PAU, CSIR, Cooperative Banks, as also NGOs and FPOs involved in implementing paddy straw management projects. Some important dignitaries include Dr. B S Sidhu, Commissioner Agriculture, Dr. J K Arora, Executive Director, PSCST, Shri Inder Mohan Singh, Additional RCS, Govt of Punjab, Director, dairy development and Director (Extension), Director, Agriculture and Director, Animal Husbandry. The purpose of the workshop was to bring together all the concerned stakeholders, to identify the roles of various stakeholders, to learn and identify the best practices to manage the crop residue in Punjab so that an implementable action plan can be prepared and submitted to the Government of India, for accessing funds under NAFCC for Punjab state. The introductory presentation was made by Shri Kuldeep Singh, DGM HO, Mumbai. The presentation laid down the related NABARD's Mission, "Straw is an asset and not a liability" and focused on various interventions proposed by NABARD to manage the crop / paddy straw burning in Punjab, and also emphasized on the in situ management of the residue. Organizations such as NTPC, National Physical Laboratories (CSIR) also gave their presentations suggesting the alternatives to gainfully manage the paddy straw. The other major points discussed during the meeting were about utilizing the paddy straw as fodder for the animal along with fruit and vegetable residue, and also to be used as fuel to generate electricity , etc.

All the interventions identified were deliberated upon and emphasis was given on best utilisation of financial resources with definite outcome. Accordingly the each interventions proposed were discussed and views given by the participants were as under:

Sr. No.	Interventions proposed	Views expressed by Participants
1	Area under in situ management needs to be increased and area indicated under incorporation of crop residue into the soil should be emphasised.	This intervention needs to be given priority in the proposal and area indicated should be more than 10 or 15 lakh ha. in Punjab.  The financial support either through MSP or through other ways may be considered.
2	On farm Compost making through NADEP system	The financial allocation for this component may be on lower side and may be only for capacity building activities rather than a major intervention.
3	Setting up of Custom Hiring units for collection and to ensure end use of crop residue.	Divergent views on this interventions were observed ; The cost of baler is around Rs. 11 lakh and entrepreneurs have indicated economic life of baler between 2-4 years.  Large farmers availed the baler but after getting the financial support, the machinery was disposed off. So PACS/FPOs and Group

		<p>approach may be best option for such interventions.</p> <p>Dept. of Agriculture is providing financial assistance and same is to be converged with existing schemes.</p> <p>Alternative uses of crop residue management such as fodder use, briquetting, etc. may be included in the proposal on pilot basis.</p>
4	Any other suggestions	<p>Diversification of cropping pattern may be included in the proposal.</p> <p>Awareness among farmers to be location specific and demo units needs to be set up at local level.</p> <p>Awareness programmes to be designed with local consultations.</p> <p>Machineries of unbranded manufactures should not be supported under any Govt programme.</p> <p>Prices of branded machineries needs to be rationalised.</p> <p>Treatment of paddy straw as fodder may be included in the proposal.</p>

**Major Outcomes of Stakeholder consultation:**

- ✓ Area under in situ management needs to be increased and major component has to be incorporation of crop residue into the soil.
- ✓ Diversification incentives of cropping pattern for farmers may be considered
- ✓ Small portion of compost making may be included.
- ✓ Custom hiring centres of all types to be included in the proposal.
- ✓ Selection criteria of financial support to be converged with existing schemes/programmes
- ✓ Various pilot of small size on location specific basis may be included in the proposal.
- ✓ Awareness programme may be organised at village/local level and content development of awareness programmes may be through CEE or any other suitable agency as it will convey the right message in shorter time.
- ✓ On farm training programme may be organised for effective participation of farmers.
- ✓ Technology acceptance and income generation for farmers may be properly designed.
- ✓ Learning and knowledge management component to capture and disseminate lessons learned for the proposed project.

### **3) NAFCC Proposal on Crop Residue Management – Stakeholders consultation meeting at Haryana**

A stakeholder's meeting on Crop Residue Management was organized by NABARD on 21 December 2017. It was chaired by Smt.Dheera Khandelwal, ACS- Environment Department, GoH.

The purpose of conducting the meet was to obtain feedback from the participants on the different interventions proposed, under the captioned project prepared by NABARD, to be considered under NAFCC. The meet commenced with a warm welcome to the participants by ShMrinalRanjan, AGM –NABARD.

Sh. Arun Kumar Shukla, CGM NABARD in his opening address discussed on the magnitude of the problem of Crop Residue burning and its environmental implications. It was highlighted that paddy stubble burning adversely affects not only human health but also decreases soil fertility besides contributing, significantly, to smog generation, carbon emission and global warming. Conceptualized on the suggestions of Chairman- NABARD on his visit to the State earlier in the year, the current project proposal incorporates both financial assistance and capacity building component. A workshop on the Crop Residue Management organised by NABARD and GIZ had yielded several alternative usage of paddy straw, which included inter-alia, In-situ straw management, Conversion to Organic Manure, Bio-Mass energy generation, use as fuel in furnace. NABARD Haryana RO had undertaken a project –“From Ash to Opportunity” in Barnah Village, Kurushetra. Invited feedback on the project as well as ideas for new projects so that a pipeline of projects could be proposed under the different Climate Finance Funds- UNFCCC, GCF, NAFCC.

Sh. Shailendra Shukla, Chairman HAREDA highlighted the various opportunities in Bio-mass vertical wherein he highlighted the need of putting in place Bio-mass Collection networks for collection. He quoted a 2012 study which concluded the state had around 84 lakh tonnes of surplus biomass. Power projects had the capacity of utilizing around 2 lakh tonnes of paddy straw. 23 projects had been implemented under the HAREDA policy with 78.9 MW installed. As a rule of thumb, 2kg of biomass is required for production of 1 unit of electricity. Thus a potential of 1000 MW is available. However, even if the fixed capital charges are subsidized, the variable cost/operating cost is high which prevent bio-mass energy generation as a lucrative alternative. RFP for 2 plants based on Bio-mass have been floated. Maharashtra model of paddy straw collection and treatment can be explored and customized to the needs of the state.

Smt. T.S Raji Gain, CGM NABARD, HO

Establishing a climate resilient community in addition to Crop Residue Management. Stubble burning adversely affects soil fertility, thus better residue management is required not only as a mitigating technology but also

ensuring higher farmer income and productivity. Healthier, cleaner environment as co-benefit.

- ✓ The farmers are growing different crops, in different agro-climatic conditions and hence a bouquet of interventions is required/ customized solutions.
- ✓ Awareness creation amongst the farmers about the economic loss suffered due to stubble burning. Hand-holding through demonstration units and pilot projects. Awareness about the different alternatives of utilizing the crop residue and making it economically feasible.
- ✓ Stressed on “In -Situ” management playing the major alternative to stubble burning, decreases transportation cost, increases organic content and soil moisture. Use of machines –Happy Seeder etc.
- ✓ Exploring composting as a business opportunity for FPOs /JLGs/SHGs.
- ✓ Need of anchoring the programme of Crop residue Management – an implementing entity. Provide access to technology, credit and capacity building of users under the programme.

Smt. Dheera Khandelwal, ACS- Environment Department, GoH. Presented the macro picture of the problem and highlighted following points ;

- NAFCC started in 2015-16, Allocation of Rs 180 cr all over India
- Environmental crisis is increasing, Interventions by Centre/State/NGT
- 65 lakh tonnes of paddy stubble.
- Cropping pattern of crops needs to be revised, crop diversification to less water intensive crops
- Imminent water crisis, hence need to switch to dryland farming
- Ideas floated regarding – metering of underground water, Conceptualization of compensatory charges for water usage.
- Highlighted reasons of severe smog in recent years owing to the contemporary weather conditions. Quoted IIT Kanpur’s study on major pollutants. Re-iterated the fact -Pollution affects not only NCR residents but the farmer’s themselves. Decreased productivity/disease prone/ medical expenses .
- Emphasises on the role of progressive farmers in encouraging others to take the initiative, roping in Children to spread awareness about the situation.

End of Inaugural Session.

Technical Session

Sh D.K Behera , Director Agriculture and Farmer’s Welfare

- The numbers behind the problem . Cost of Straw management is Rs 1500 per acre. 13.20 lakh hectare- paddy cultivation, 7.67 lakh. Basmati . major problem in managing the non-basmati straw management.
- Target area for straw management under State Action Plan 2018-19: 6.81 lakh Ha of paddy cultivation ., Rs . 600 crores for next FY ( 50 % subsidy from government )
- Ongoing Scheme: SMAM ( Sub Mission on Mechanization of Agriculture)- Subsidy upto 40 % of project cost for custom hiring centres.
- Total funds available under SMAM: Rs . 75 crores, departmental purchase under RKVY – Rs 22 crore



- CHCs as Business Model for the farmers, but the machineries can be operated only during harvesting and cropping season which adversely affects its economic viability. Need to promote them as round the year service centres.

Presented different interventions including, specific machineries as per the cropping pattern. he suggested

1. Combine Harvester followed by Happy Seeder having super SMS ( benefits: high organic content of soil, water conservation and reduce the sowing time ), PAU study has showed an increase in the productivity by 15 %.
2. In-situ incorporation of Paddy Straw through mulcher/ reversible plough. Requirement of high powered tractors. Soil salinity is decreased.
3. Use of paddy straw in paper, cardboard ,bio-ethanol – Industrial usage.
4. Use of paddy straw pellets, briquettes- Involvement of NTPC and private players.
5. Organic Composting using bio-decomposer developed by National Centre for Organic Farming Ghaziabad (NCOF) @ Rs 20 / bottle. (use along with 200 ltrs of water, 2.5 kg Gur and spread on 1 acre)
6. Use of paddy straw as cattle feed in combination with green fodder

#### Mr. Kuldeep Singh , DGM –Climate Cell

- NAFCC funding – purely grant component to the State Government
- Various interventions carried on in “Narwana to Kaithal”area . Farmers of Haryana selling straw to the neighbouring areas individually, need to be organized into a proper business supply chain. Converting Straw into an Asset as compared to a Liability. By not exploiting the opportunity, farmers are losing out on Rs. 6000 per ha. on burning the crop residue besides the additional inputs that are required /land development for fresh crops approx.Rs 12000.
- Highlighted the Difference between adaptation and mitigation.
- Discussed National Policy for Management of Crop Residue 2014.

Highlighted the different interventions proposed by NABARD under the project proposed under NAFCC.

1. Incorporation of straw into soil
2. Setting up of Custom Hiring centres
3. Small Custom Hiring Centre at Village level
4. Diversification of cropping pattern
5. Fodder development units for JLGs/FPOs
6. Awareness and Capacity building
7. Setting up of Briquette making units
8. On-Farm Composting
9. Regional Coordination and Monitoring centres

Activities- capacity building/workshop for stakeholders, workshop for CH owners, exposure visits, demo-units.

Opening up for contribution and feedback from the participants:

1. Better designed farm machineries, upgrading the Combine Harvesters.  
Problems: Expensive technology, Cost: 20 Lakh , Not currently manufactured in India , Will be used only for paddy stubble removal not designed for handling wheat stubbles, Design modification required , also indigenous manufacturing capacity to be enhanced.  
Demo Harvester in HAU –Hisar, feedback from Progressive farmer-ShMahendra Singh, Kaithal who has seen good results and reduction of crop loss during harvesting to around 3 %.  
Replacement of currently in use Combine -Harvesters by new designs, 10 % replacement every year.
2. From farm mechanisation to affordable farm mechanisation, emphasised on Custom Hiring Center analogous to Uber/Ola or Library model. Experience and learning for Barnah Village in Kurushetra where Happy Seeder was provided to Gram Panchayat.  
Proposed using the Paddy straw for Gaushalas, it won't have any adverse effect on the milk productivity of the livestock. He emphasised on creating more professional extension work.
3. BISA – Burning results in significant loss of nutrients like potassium, nitrogen for which extra fertilizers need to be added thus increasing the input cost for the farmers. Invited farmers for exposure visits to the farmland being maintained by the Institute.
4. Feedback from Mr. Juneja . Limited demand from the 408 Gaushalas in Haryana. Maximum potential upto 25000 Tonnes. Competition from basmati straw fodder.
5. KVK,Panchkula - Incentive based on Organic content of the soil
6. NTPC – Silica and Alkali content make the utilization of straw in thermal plants difficult. However, 2 projects are being conceptualized with capacity of 500 MT / day based on straw pellets and 500 MT /day based on Torrified Bio-mass. A tentative estimate of utilizing the straw from an area of upto 1 lakh ha. However, there's a need to encourage the various components of the entire supply chain.  
Issues- Onetime payment for procuring the straw has to be made by the pellet manufacturers, Credit facilities to such producers are essential.  
The 2 projects have a supply agreement for 2 years. The results would shed light on the viability of the project.
7. Mr Sudhakar from Aston University,England observed that Composting and use of anaerobic digestion has to be carefully implemented as it too leads to methane emissions. Hence hand-holding in the process would be essential.  
Described his venture on Pellet manufacturing. It improves the storage and transportation of the stubble.A viable business model, monetising the straw using the market forces.  
Suggested that people find stubble burning comfortable, this attitude needs to be changed.  
Emphasis on making palette form straw, as it will be easier to store and transport.He also mentioned funding problems for new company or entrepreneurs.

**4) Minutes of the Meeting of the Regional Project on 'Crop Residue Management and Prevention of the Stubble Burning' under NAFCC held on 19<sup>th</sup> December 2017 in Brahmaputra Hall, MoEF&CC, Govt. of India**

A meeting was held under the Chairmanship of Shri Ravi S. Prasad, Joint Secretary, Climate Change Division, MoEFCC to discuss preparation of a regional project on 'Crop Residue Management and Prevention of the Stubble Burning' for funding under National Adaptation Fund for Climate Change (NAFCC).

2. Representatives from Ministry of Agriculture, Central Pollution Control Board, National Agricultural Cooperative Marketing Federation of India Ltd.(NAFED), NABARD and State Governments of Rajasthan, Gujarat, Haryana participated in the meeting. List of participants is enclosed as Annexure I.

3. JS (CC) highlighted that the purpose of the meeting is to develop a regional project on 'crop residue management and prevention of the stubble burning' based on scientific understanding and State needs and priorities. He further stressed that this is an important area of concern and addressing the issue would have significant adaptation benefits in addition to mitigation co-benefits. The aim should be to identify key interventions that can be undertaken as part of NAFCC apart from other initiatives of Ministry of Agriculture, State governments and directions of the Committee headed by Principal Secretary to the Hon'ble Prime Minister.

4. The State Governments of Haryana, Rajasthan and Punjab were invited to share their views on the activities that could be undertaken as part of the project:

1. Haryana: The representatives from Govt. of Haryana emphasized the need for straw management equipment under the project.
2. Rajasthan: The representatives from Govt. of Rajasthan highlighted that the State has a number of Custom hiring Centres operational and further requirements would be projected.
3. Punjab: Representative from Govt. of Punjab mentioned that generating awareness to bring about behavioural change in farmers is a long-term priority. There is a need to identify viable options considering the field conditions and constraints. Incentivizing farmers and farm machinery was proposed for consideration under NAFCC. It was also proposed to set-up a regional centre for bio-residue management for developing technological solutions, engaging entrepreneurs etc.
4. Dr. S. S. Tomar, Addl. Commissioner, M/o Agriculture & FW, Ministry of Agriculture highlighted the Schemes of MoA for addressing the issue of crop residue management. He also provided an update on the status of funds released and progress made by the three States on this issue. It was further highlighted that funds from MoA alone would not be sufficient to address the issue.
5. Shri S.K Singh, Addl. Managing Director, NAFED emphasized the need for making machinery available to the farmers for addressing the issue. Further, the need for developing market linkages for

extraction, transportation and utilization of crop residue was identified as a critical area that could be considered under the project.

6. NADARD made a presentation, based on consultation with State governments, on activities that could be undertaken as part of the project. GIZ supplemented the presentation with possible interventions that could be undertaken. The States shared their views on the presentation and suggested to strengthen some of the ideas that could be implemented in the States as part of the project.

JS (CC) concluded the meeting by requesting NABARD to submit the Detailed Project Report (DPR) within a week. The DPR should be comprehensive and offer a menu of choices. During the first phase of project implementation, select activities could be supported under NAFCC based on State priorities. Subsequently, the scope could be enhanced and more activities be supported based on the performance during phase I.

#### **List of participants in the meeting:**

1. Shri Ravi S. Prasad, Joint Secretary, MoEF&CC
2. Shri Shard, Joint Director-Climate Change Division, MoEFCC
3. Dr. S. S. Tomar, Addl. Commissioner, M/o Agriculture & FW
4. Shri Tarun Darbari, Scientist D, CPCB
5. Dr. B.S. Sidhu, Govt. of Punjab
6. Dr. Jitendu Kaul, Govt. of Punjab
7. Dr. Charanjit Singh, Govt. of Punjab,
8. Dr. S.S. Ladhar, Govt. of Punjab
9. Shri Prital Singh, Govt of Punjab
10. Shri P.K. Bhardwaj, Govt. of
11. Shri S. K. Singh, Addl. Managing Director, NAFED
12. Shri K.N. Khandelwal, Govt. of Rajasthan
13. Dr. Anil Rana, Govt. of Haryana
14. Dr. Vivek Saxena, Govt. of Haryana
15. Shri Sunil Kumar, NABARD
16. Shri Kuldeep Singh, NABARD
17. Shri Jai Kumar Gaurav, GIZ
18. Ms. Ridhima Sud, MoEF&CC
19. Asit Kumar Misra, MoEF&CC

## **Annexure 4:**

### **Project Component:**

### **Regional Bio-Residue Management Technology Facilitation Centre**

#### **Background**

Punjab, Haryana, Western U.P. and parts of Rajasthan are major rice and wheat producing states in the country. These crops, besides giving food grain, produce large amounts of agro-wastes. Whereas, agro-waste from wheat i.e. wheat straw, is almost fully consumed, as it is mainly being used as animal fodder, paddy straw is rarely preferred as fodder specially in these states due to its low nutritional value and availability of green fodder. Hence, paddy straw is burnt in fields adding carbon emissions that contribute towards climate change. As per CII NITI Aayog's report on biomass management, these four states burn about 39 million tonnes of paddy straw every year which excludes paddy straw of basmati rice. Although the states are taking many steps to propagate the use of paddy straw for in-situ mulching, use of biomass in power generation units, biogas generation, etc. However, these technologies are not enough to curb the practice of field burning of paddy straw since these are cost intensive and have limitations for proper combustion due to high silica, chloride and alkaline contents. In addition, due to low bulk density of paddy straw, its collection and storage is also a challenging task.

Since this issue is of prime National importance, identification of technologies suitable to the local conditions and their promotion for gainful utilization in different activities is need of the hour.

Proper management and utilization of this paddy straw is one of the major challenges at National level, as appropriate technologies and mechanisms in this regard are available developed/identified at a limited extent. Thus, there is a need to establish Regional Resource Centre for inventorisation/identification of new and innovative technologies, identification of gaps in the existing technological solutions, facilitating R&D for further improvement and setting up of cluster based demonstration units for promotion of use of paddy straw in the region. Therefore, a proposal is being submitted for setting up of 'Regional Bio-Residue Management Technology Facilitation Centre' under aegis of Punjab State Council for Science & Technology at Mohali.

#### **Objectives and proposed activities :**

- ✓ Preparation of inventory/data bank on the technologies being presently employed for use of paddy straw both at national and international level.
- ✓ Assessment of utilization/demonstration of technologies suitable in the region, marketability of the end products keeping in view sustainability issue.
- ✓ Identification of gaps in the existing technologies and processes.

- ✓ Identification of new and innovative interventions/technologies.
- ✓ Promote relevant R&D for further improvement.
- ✓ Collaboration with national and international institutions/industry/farmers association for gainful utilization of paddy straw.
- ✓ Coordination for setting up of cluster based demonstration units for promotion of use of paddy straw in the region.
- ✓ Preparation of bankable project templates.
- ✓ Facilitate removal of barriers with regard to technology know-how, access to loan and promotion of end product to make the technology self sustainable.

The Centre is proposed to be set up at one acre land available with Punjab State Council for Science & Technology in the Knowledge City, Sector 81, Mohali which is centrally located and well connected with the stakeholder states. This Centre would serve as Knowledge Hub for providing technological know-how in the region on the new and innovative solutions to manage/gainfully use paddy straw except for those being promoted by the Dept. of Agriculture of respective states for *in-situ* management and reincorporation in soil. The tentative cost of the Centre for three years is Rs.19.09 crores as per details given below:

### C. Budget Estimates: Summary

S. No.	Item	Budget (Rs. in lacs)			
		1 <sup>st</sup> year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	Total
A.	Recurring				
1	Manpower : (Scientist 'E', Scientist 'C', Principal Scientist/Engineer, Senior Research Fellow (4), Data Entry Operator (2), Field/Lab Assistant (2), Admin-cum-Accounts Officers).	52.68	74.66	80.37	0207.71
2	Consumables	52.680	74.66.00	80.37.00	207.710
3	Travel	3.00	6.00	6.00	15.00
4	Technology Demonstration	150.00	300.00	300.00	750.00
5	Contingencies	15.00	15.00	15.00	45.00
		273.36	470.32	481.74	1225.42
B	Non-Recurring				
6	Permanent Equipment	546.720	-	-	2450.840
7	Building construction cost	100.00	350.00	250.00	700.00
	Grand Total (A+B)	464.98	780.66	663.37	1909.01

Financial Year: April to March

## Budget For Salaries/Wages

S. No.	Designation	Monthly Emoluments (lac/month)	Budget (Rs. in lacs)*			Total
			1 <sup>st</sup> year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	
Full Time						
1	Scientist 'E' (Scale 37400-69100 + 8700 GP + 5% IR + 20% HRA + 12% EPF)	1.60	(12 mm) 19.20	(12 mm) 21.50	(12 mm) 24.08	64.78
2	Scientist 'C' (Scale 15600-39100 + 6600 GP + 5% IR + 20% HRA + 12% EPF)	0.90	(12 mm) 10.80	(12 mm) 12.10	(12 mm) 13.55	36.45
3	Principal Scientist (Rs.60,000/- per month including 20% HRA & 12% EPF)	0.60	(6 mm) 3.60	(12 mm) 7.20	(12 mm) 7.20	18.00
4	Senior Research Fellow-4 (Rs. 28000 + 20% HRA + 12% EPF) as per DST Office Memorandum SR/S9/Z-09/2012 dated 21.10.14	0.40	(6 mm) 9.60	(12 mm) 19.20	(12 mm) 19.20	48.00
5	Data Entry Operator - 2 (as per DC rates approved w.e.f. 1.4.2017 to 31.3.18 by DC, Chandigarh)	0.19	(12 mm) 4.56	(12 mm) 5.24	(12 mm) 6.03	15.83
6	Field/Lab Assistant - 2 (as per DC rates approved w.e.f. 1.4.2017 to 31.3.18 by DC, Chandigarh)	0.13	(6 mm) 1.56	(12 mm) 3.44	(12 mm) 3.88	8.88
7	Admin-cum-Finance (Scale 15600-39100 + 5400 GP + 5% IR + 20% HRA + 12% EPF)	0.56	(6 mm) 3.36	(12 mm) 5.98	(12 mm) 6.43	15.77
Total			52.68	74.66	80.37	207.71207.71

\* man months (mm) given within brackets before the budget amount.

Note: The salary of existing scientists/engineers would be charged to the posts of Scientist 'E', Scientist 'C' and Project Scientist whereas the remaining posts would be recruited through open advertisement.

## Budget For Consumables

S. No.	Items	Budget (Rs. in lacs)*			
		1 <sup>st</sup> Year	2 <sup>nd</sup> Year	3 <sup>rd</sup> year	Total
1.	Development of IEC material	0.50	2.00	1.00	3.50
2.	Stakeholders meetings	2.00	2.00	2.00	6.00
3.	Stationery, telephone, internet, photography etc.	1.00	1.00	1.00	3.00
4.	Maintenance / consumables of instruments	1.00	2.00	2.00	5.00
5.	Monitoring/testing charges	2.00	2.00	2.00	6.00
6.	Rental of premises and associated charges	26.00	26.00	4.00	56.00
	Total	32.50	35.00	12.00	79.50

\* Details are placed at Annexure-I

## Budget for Travel

Item	Budget (Rs. in lacs)			
	1 <sup>st</sup> year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	Total
Travel	2.40	6.00	6.00	14.40
Total	2.40	6.00	6.00	14.40

Note: One vehicle shall be hired to meet the travel requirement of technical staff of technology demonstration centre. The vehicle is proposed to travel for 3000 km / month @ Rs. 40000/-

## Budget for Permanent Equipment

Item	Budget (Rs. In lacs)			
	1 <sup>st</sup> year	2 <sup>nd</sup> Year	3 <sup>rd</sup> Year	Total
Office furniture & fixtures	70.00			70.00
Data stations with peripherals	10.00	-	-	10.00
Laptop – 2 No.	1.80	-	-	1.80
Lab equipment (Thermal imager, bomb calorimeters, GLC, PM <sub>2.5</sub> Kit, etc.)	30.00	-	-	30.00
Total	111.80	-	-	111.80



## **Annexure 5:**

### **Crop Residue in the State of Rajasthan:**

In India a huge volume of crop residues are produced both on-farm and off-farm. It is estimated that approximately 500-550 Mt of crop residues are produced per year in the country. These crop residues are used for animal feeding, soil mulching, bio-manure making, thatching for rural homes and fuel for domestic and industrial use. Thus crop residues are of tremendous value to the farmers. However, a large portion of the residues is burnt on-farm primarily to clear the field for sowing of the succeeding crop. The problem of on-farm burning of crop residues is intensifying in recent years due to shortage of human labour, high cost of removing the crop residues by conventional methods and use of combines for harvesting of crops. The residues of rice, wheat, cotton, maize, millet, sugarcane, jute, rapeseed-mustard and groundnut are typically burnt on-farm across different states of the country.

Rajasthan has the largest geographical area in India covering one-tenth of country's land area wherein just 5.7% of the country's population reside. Of the total 68.5 million human population in Rajasthan, 75.1 per cent reside in rural areas and 24.9 per cent in urban areas. Being the main source of occupation, Agriculture continues to play a prominent role in the employment with 62% of the total workers of the State engaged in Agriculture [census 2011]. The declining share of the agriculture and allied sector in Gross State Domestic Product (GSDP) is consistent with normal development trajectory, but fast agricultural growth remains vital for jobs, incomes and food security.

As per a study conducted by IARI on "Crop Residues Management with Conservation Agriculture: Potential, Constraints and Policy Needs", in the state of Rajasthan, as per IPCC coefficient a total of 13% crop residue is burnt of the total crop residue generation and 6% as per the Pathak et.al.2010 estimates.

### **Crop Residue**

Crop residue is an important product of agriculture and is of great economic value as livestock feed, fuel and industrial raw material, and in conservation agriculture for which it is a pre-requisite. Farmers, in the states like Punjab, Haryana, Uttar Pradesh and Rajasthan, resort to burning of crop residue due to various reasons which also contributes in increasing environmental pollution levels in addition to loss of useful resources. Agriculture Ministry issued an advisory to the state governments to create awareness among the farmers about the harmful effect of straw burning.

Facilitate farmers residue management machines and equipment such as Zero Till Seed Drill, Happy Seeder, Straw Baler, Rotavator, Paddy Straw Chopper/ Mulcher, Gyro Rake, Straw Reaper, Shredder, etc., to through Custom Hiring Centres or village level Farm Machinery Banks.

The State Governments have also been directed that Rs. 4000/ Hectare shall be used from the funds available for demonstration of machines under Sub-Mission on Agricultural Mechanization for demonstration of straw management machinery at farmers' fields. The All India status of crop residue is as under:

***Crop Residue Generation and Burnt: All India Status***

State	Crop residues generation (MNRE, 2009)	Crop residues surplus (MNRE, 2009)	Crop residues burnt (based on IPCC coefficients)	Crop residues burnt (Pathak et al. 2010)
	Mt yr <sup>-1</sup>			
Andhra Pradesh	43.89	6.96	6.46	2.73
Arunachal Pradesh	0.40	0.07	0.06	0.04
Assam	11.43	2.34	1.42	0.73
Bihar	25.29	5.08	3.77	3.19
Chhattisgarh	11.25	2.12	1.84	0.83
Goa	0.57	0.14	0.08	0.04
Gujarat	28.73	8.9	9.64	3.81
Haryana	27.83	11.22	6.06	9.06
Himachal Pradesh	2.85	1.03	0.20	0.41
Jammu and Kashmir	1.59	0.28	0.35	0.89
Jharkhand	3.61	0.89	1.11	1.10
Karnataka	33.94	8.98	3.05	5.66
Kerala	9.74	5.07	0.40	0.22
Madhya Pradesh	33.18	10.22	3.74	1.91
Maharashtra	46.45	14.67	7.82	7.41
Manipur	0.90	0.11	0.14	0.07
Meghalaya	0.51	0.09	0.10	0.05
Mizoram	0.06	0.01	0.02	0.01
Nagaland	0.49	0.09	0.11	0.08
Odisha	20.07	3.68	2.61	1.34
Punjab	50.75	24.83	9.84	19.62

Rajasthan	29.32	8.52	3.84	1.78
Sikkim	0.15	0.02	0.01	0.01
Tamil Nadu	19.93	7.05	3.62	4.08
Tripura	0.04	0.02	0.22	0.11
Uttarakhand	2.86	0.63	0.58	0.78
Uttar Pradesh	59.97	13.53	13.34	21.92
West Bengal	35.93	4.29	10.82	4.96
India	501.76	140.84	91.25	92.81

### **Biomass Energy in Rajasthan**

The Government of Rajasthan has accorded a high priority to setting up power projects based on nonconventional energy sources in the State. With a view to promote generation of power from these sources, Government of Rajasthan issued a "Policy for Promoting Generation for Electricity from Non-Conventional Energy Sources" in 1999.

Keeping in view the requirements, this Policy has been amended from time to time. Lately, the Government of Rajasthan had issued "Policy for Promoting for Generation of Electricity from Biomass, 2010" (Policy-2010).

It was found that on an average about 92.5% of Biomass generated from the agricultural activity goes for consumption in local for fodder, manure, fuel for thermal energy consuming industries, biomass power plants, brick kilns etc., and about only 7.5% is available for other activities or exported to nearby states. The major portion of wheat stalks, barley stalks, paddy hay, jowar stalks, bajra stalks, maize stalks are consumed by animal as fodder and these biomass should not used as a fuel per the Policy of 2010. Mainly Mustard stalks, husks and soybean stalks are used for power generation as can be seen from their generation and consumption pattern.

There is a surplus of 11,62,679 tons /year of Mustard stalks and husks. Similarly, there is a surplus of 3,32,178 tons/year of Soybean stalks and husks which can be used as feedstock in the power generators as shown in table1. This mustard husk, which is considered a total waste and not even used as fodder for cattle, is very light with a density of about 105 Kg/m<sup>3</sup>.

#### **Generation and Consumption pattern of Biomass in Rajasthan**

S. No	Crops	Biomass	Generation Tons/year	Consumption Tons/year	Surplus Tons/year
1	Paddy	Paddy Straw	4,20,227	420227	0
2	Jowar	Jowar Stalks	10,71,614	10,71,614	0
3	Bajra	Bajra Stalks	1,42,48,890	1,42,48,890	0
4	Maize	Maize Stalks	42,62,910	42,62,910	0
5	Moong	Moong Stalks	6,38,596	5,19,585	1,19,012
6	Urd	Urd Stalks	1,52,211	1,19,047	33,164
7	Moth	Moth Stalks	8,75,033	7,63,804	1,11,229
8	Soybean	Soybean Stalks	22,50,632	19,18,453	3,32,178

9	Mustard	Mustard Stalks	63,56,045	51,93,365	11,62,679
10	Cotton	Cotton Stalks	8,86,306	5,35,587	3,50,720
11	Wheat	Wheat Stalks	1,56,75,533	1,56,75,533	0
12	Guar	Guar Stalks	32,46,627	25,49,705	6,96,922
13	Castor	Castor Stems	13,50,342	8,42,628	5,07,715
14	Barley	Barley Stalks	11,62,091	11,62,091	0
15	Gram	Gram Stalks	14,14,045	10,60,534	3,53,511
16	Ground Nut	Ground Nut Stalks	16,16,475	11,73,568	4,42,907
17	Sesame	Sesame Stalks	2,55,938	1,76,846	79,092
		Total	5,58,83,516	5,16,94,386	41,89,129

Source : *Rajasthan Biomass fuel supply study, 2015 [3]*

#### District wise Biomass Availability and Potential in Rajasthan

S No.	District	Tehsil	Biomass	Tons
1.	Sirohi	Abu Road	Caster stalks Mustard / Rap seed stalks	5287
2.	Kota	RamganjMandi	Maize & Mustard/ Rap seed stalks	4625
3.	Baran	ChhipaBarod	Mustard Stick/Dhaniya stalk	4008
4.	Dungarpur	Sagwara	Crop residue & Fuel wood	8642
5.	Sikar	Neem-ka-Thana	Crop residue & Fuel wood	20584
6.	Ganganagar	Gharsana	Crop residue & other sources	22066
7.	Churu	Sardarshahar	Agro-waste	37930
8.	Jalore	Bhinmal	Mustard Caster stick	108079
9.	Pali	Bali	Crop residue Fuel wood waste	69936
10.	Bhilwara	Mandalgarh	Crop residue Fuel wood waste	20166
11.	Jhunjhunu	Chirawa	Crop residue	50621
12.	Nagaur	Merta city	Crop residue	129565
13.	Barmer	Chohtan	Jeera stalk bushes	98136
14.	Bikaner	Bikaner (Khara)	Bushes Groundnut stalk	101573
15.	Jaipur	Kotputli	Crop-residue Fuel wood waste Agro-waste	28704
16.	Jodhpur	Phalodi	Bajra-moth Mustard-chilli stalks	127114
17.	Bharatpur	Roopwas	Mustard/stick & bushes	43042
18.	Alwar	Rajgarh	Crop residue Fuel wood waste	24772
19.	Tonk	Niwai	Crop residue & industrial residue	36132
20.	Sawai	Bonli	Crop residue like Mustard and	36122
21.	Madhopur		sesam stalk	

Source : <http://investrajasthan.com/lib/bpulse/022006/bio.html> [8]

More than 90 percent of the mustard husk used to be burnt by the farmers in their fields and mixed with the soil to prepare the fields for the next crop. Sometimes the farmers had to pay money to get their fields cleaned of this waste. Even now 1.5' to 2' long stems, left in the field while manually cutting

the plant, are either ploughed or burnt and mixed with the soil and thus are not being used for better purposes like converting it into energy or making proper manure for agricultural purposes.

### **Details of FPOs promoted in the State:**

In Rajasthan, 145 FPOs have been sanctioned to through 51 POPIs. So far, around 30000 farmers have been brought into the fold of FPOs which includes around 7000 women farmers. The average membership of these FPOs has crossed 200 farmers. 143 FPOs have been registered so far. Out of which, 137 FPOs have been registered as Producer Companies under the Companies Act, 2013 and the remaining six FPOs have been registered as Cooperative Societies under the Rajasthan Cooperative Societies Act, 2001. So far, an amount of more than Rs.2.0 crore has been mobilized from the farmer members. Credit linkage is yet to happen for FPOs.

Out of the 145 FPOs promoted under PRODUCE fund, none of the FPO is doing custom hiring activity in the state. These FPO may take up custom hiring in future after due capacity building and experience.

### **NABARD's intervention in crop residue Management:**

NABARD, Rajasthan RO has sanctioned a study titled "Promotion of Conservation Agriculture Technologies for Effective Wheat Crop Residue management as alternative to standing stubble Fire burning in one selective cluster in Kishanganj block of Baran District of Rajasthan" under NABARD-Farmer Technology Transfer Fund (FTTF) with a total outlay of Rs.11.075 Lakh at 5 villages in Cluster of Kisanganj of District Baran in Rajasthan with a duration of the Project: - Two years (January 2014 to December 2015) by Implementing Agency "GraminVikas Trust"

About Project: The project is directly related to agriculture. This project was implemented in five villages as pilot project and then the success of the project was studied / measured. The project aimed at "holistic development" of the agriculture. The project was focused on three bottom lines viz. demonstration and adoption of proper agricultural practices, acceptance of agriculture mechanization and setting up a community based fodder bank which were established in the study area by the project team and KVK, Anta-Baran with the backward & forward linkages. The project was embarked on capacity building of the participating farmers' by the KVK, Anta-Baran. This resulted in enhancement of self-confidence of the small and marginal farmers of the areas and thus was impact in the rural development as GVT was focused on coverage of maximum women members resulting in women empowerment. The project focuses on conservation of residual crops and then utilizes it for the fodder for the milch cattle as well as other animals. The generation of fodder is tremendously helps the dairy farmers of the area

and also motivates the farmers in adopting of dairying as a source of sustainable livelihood.

#### Major Findings and Impact of Wheat Crop residue Management on various Components:

1. Effect on Yields and productivity: As a result of the joint efforts made by the GVT team and the KVK Experts, the level of mechanization increases crop productivity up to 5.11 to 38.25 percent, saving in seeds and fertilizer 13.22 to 38.45 per cent, Enhancement in cropping intensity increases from 10.2 to 16.34. Increase in gross income of the farmers has also been from 25 to 45 per cent.

2. Impact on Soil health: Improvements in the number of physical, chemical and biological properties of soil were observed. The significant increase was observed in organic matter, total nitrogen, extractable carbon, polysaccharide, soil activity, electrical conductivity and available phosphorus, potassium. This improvement was due to reduction in loss of entire carbon, 80% nitrogen, 25% phosphorous and 20% potassium. The increased efforts ensured rapid decomposition and turnover of organic matter, resulting in greater amounts of available nutrients for next crop.

3. Impact on environment: The decrease in straw burning and due to the promotion of agricultural mechanization, these all indicators directed to the promotion of eco-friendly environment of cropping. The aim behind the adoption of this approach was optimum utilization of the available resources of human, cattle and mechanical/electrical power and also removing the drudgery associated with various agricultural operations. These all efforts cumulatively ensured the improvement in environmental parameters.

4. Impact on Socio-economic environment: Due to the increased efforts by GVT team and the KVK against straw burning, watchful eyes of farmers have been able to see the adverse impact of straw burning on their fields. Besides, the project support has provided financial assistance to farmers for owning a wide range of agricultural equipment viz. tractors, power tillers, bullock/tractor drawn implements, 26 reapers, threshers, irrigation equipment, hand tools, etc. Further, new equipment such as precision planter, zero-till drill, seed cum fertilizer drill, raised bed planter, improved weeder, plant protection equipment, harvesting and threshing machines, drip, micro sprinkler and sprinkler irrigation equipment have been made available to the farmers. A social and financial improvement was also observed through various combined operations.

**Evaluation:-** A survey has been conducted in Oct-2016 to know about the results of project not only on the beneficiaries associated with this scheme but also the farmers who have replicated it in their farms independently. The result which we have extracted from this survey very impressive. Farmers

who were not directly benefited with the project were also now aware about the adverse effects of straw burning practices on the field. They are now enough knowledgeable regarding the bad impacts of it on their fertile land and environment. Through generation of awareness, the project demonstrated good agricultural practices on the farmers' field. The agricultural demonstration associated with IEC drive could disseminate the result of the project beyond beneficiaries.

Almost all the farmers shared about the effective result of this technique. Now they are aware regarding the importance of fodder. Some of them also told that after adopting this practice they are getting an increased volume of profit from the production. They are happy and appraised the work of GVT with respect to the soil and land treatment. Due to the adoption of this technology, soil health has been improved and nutritional security also increased up to the remarkable level. Soil health evaluations were recorded from selected farmer's field. Crop productivity has been enhanced through conservation agriculture practices. Milk productivity improved among mulch cattle through quality fodder availability round the year as well as veterinary health services & breed improvement measures. Occurrence of farm weed as well as attack of pest/diseases reduced through adoption of conservation agriculture practices. Environmental hazards were reduced through discouraging burning practices. With timely harvesting operation of crop residue, field were vacated up to early April which allowed farmers for sowing of early maturing green gram or many other summer crop. Stopping of Wheat husk burning enhanced saving of fodder and increased utilization of it as cattle feed. Efficient use of wheat crop residue as a quality fodder in lean period was done through a promotional technique of crop residue management. Local community has been made aware regarding the proper conservation agricultural practices and environment sustainability.

### **Custom Hiring Centres in Rajasthan**

Custom Hiring Centres' are being established by the Government of Rajasthan with the aim of making farm mechanization accessible for small and marginal farmers in the State. This unique scheme has been started with the objective of promoting farm mechanization in agriculture and allied sectors under the 'Mission on Agricultural Mechanization. In an ideal situation, one 'Custom Hiring Centre' can make available advanced agricultural machinery for farmers within an area of 10 km<sup>2</sup>. These will be especially beneficial for small farmers as well as the cultivators living in remote areas of the State. State govt. has planned to open 2,652 such centre in next three years.

TAFE – Tractors and Farm Equipment Limited, India's second largest tractor manufacturer, has announced the launch of 'JFarm Services App' – a

mobile app-based aggregator platform which facilitates hiring of tractors and modern farm machinery for farmers in Rajasthan, at the Global Rajasthan Agritech Meet (GRAM), Kota. Available on Google Play Store, the JFarm Services App is free and will connect Custom Hiring Centres (CHC) operated by tractors and equipment owners directly to farmers who need farm mechanization services and solutions, thereby facilitating a fair and transparent rental process while focusing on quality, dependability and timely delivery.

**Promotion of Farm Mechanisation through Custom Hiring Centres by PACS:** In the state of Rajasthan, there a total of approximately 6328 PACS (in profit 4428) working in the state. Out of these PACS, only a few are involved in the custom hiring business and that is also not directly. Hence, we may identify good potential PACS in the high volume of bio mass generation districts and may promote such custom hiring centres through these PACS for better managing the crop residue.

### **Feed Resources in Rajasthan - Availability vs. Requirement**

In Rajasthan, dairying is the most reliable source of earning to farmers. The livestock keepers have traditionally relied on common grazing lands “gochars”, sacred groves “orans” and forests. The permanent pastures and other grazing land reduced from 1.9 million ha. in 1990-91 to 1.7 million ha in 2009-10. With disappearing grazing land, restricted forest and stall feeding, the bovine are facing a severe shortage of fodder.

Now the dairy farmers are shifting from extensive open grazing system to semi-intensive and intensive stall feeding system which require huge quantity of dry matter/fodder in addition to green fodder.

The year wise status of availability, requirement and surplus/deficit of Dry Matter in Rajasthan is as under :-

Year	Dry Matter ('000MT)		
	Availability	Requirement	Surplus/Deficit
1992	33571	55046	-21475
1997	35848	66634	-30786
2003	29523	66153	-36330
2007	45655	74298	-28643
2008	47310	76464	-29154
2009	47052	78929	-31877
2010	38218	81703	-43485
2011	40809	84808	-43999

(Source: *Dairying in Rajasthan- A statistical Abstract 2016 - NDDB report*)



As indicated in above table, there has always been shortage of dry matter (dry fodder) for animal consumption in Rajasthan. District wise data analysis also indicates shortage of dry matter in all district of Rajasthan. This scenario indicates a great potential for distribution of dry matter in deficit areas and processing/conversion of dry matter into nutritious fodder for animals. The existing infrastructure consisting of PACS, FPO, Farmers Club, Dairy Cooperatives, NGOs, etc. can be used for awareness creation and making available the crop residue from nearby state for the dairy farmers of Rajasthan. These initiatives may requires viability gap support initially. The existing dairy cooperative structure is proposed to be used for the collection, distribution and processing of fodder.

### **The Dairy Cooperative structure in Rajasthan:**

The dairy co-operative movement operates on three tier system wherein farmer members own dairy co-operative societies (DCS) which own district milk producer's union. The unions collectively own the RCDF. It is a vertically integrated structure that establishes a direct linkage between those who produce the milk and those who consume it.

**Federation** - Provides service & support to unions. Marketing within & outside state, Liaison with government and NGO agencies, mobilisation of resources & coordinating & planning programmes / projects.

**Union** - Develops village milk cooperative network, procures milk from DCS, processes & markets. Sale of cattle feed and related inputs, promotion of cross breeding through AI and NS, promotion of fodder development and general support & supervision to DCS. There are 21 milk unions in Rajasthan.

**Dairy Co-operative Societies (DCS)** - Provides input services (AH, AI) to its members and procurement of milk.

NABARD RO can tie up with District level union and RCDF for collection, transportation, processing and distribution of fodder at various places. The work can be executed through DCS.

### **Fodder for Gaushala & Sheep herder migration in Rajasthan**

There are large numbers of registered (2319 ) Gaushalas in Rajasthan with 6.7 lakh *gavash* (cows) which require huge volume of fodder for maintenance of animals. Even death of cows have been reported due to shortage of fodder. National Rainfed Area Authority, Planning Commission, Government of India, has also issued Livestock Feed and Fodder Advisory for the States of Karnataka, Maharashtra, Gujarat, Rajasthan, Punjab and

Haryana due to shortage of livestock feed and fodder in view of overall rainfall deficit. The strategy/advisory for Rajasthan state includes

- i. Establishment of Fodder Banks for storing and distribution of dry fodder need to be strategized.
- ii. A large number of Gaushalas exist in the State. The list of Gaushalas and their capacities could be updated, their managers informed and financial assistance assured for setting up fodder/feed banks and livestock camps at short notice.
- iii. Sheep herders migrate with their flock for long distances in search of fodder. Provision for supply of mineral mixture and for de-worming of the animals during migration would ensure maintaining body weight and lower mortality.

**Other uses of crop residue in Rajasthan:-**

- a. Kalpataru Power Transmission Limited (KPTL), a leading global engineering, procurement and construction player in power sector, is successfully generating energy from crop residues in Ganganagar and Tonk districts of Rajasthan. At Tonk, the plant utilizes 80,000 tons of biomass, mostly from mustard crop, annually and generates 1.5 lakh kWh energy per day. However, the plant produces a large amount of bio-ash requiring its management in a profitable manner.
- b. A Crop residue identification unit (with approximate cost of Rs 7.00 crore) is being set up at Hanumangarh by Rajasthan Cooperative Dairy Federation with the assistance of NDDB and is expected to be commissioned during December 2017.