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"An Evaluative study of Issues and Challenges of Sustainable Agricultural Practice in Saharsa District of Bihar (India)"

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ABSTRACT

Saharsa district of Bihar is situated in the Eastern Plains 15 of Agro Ecological Sub Region (ICAR). It is into the Middle Gangetic Plain-IV as per Agro Climatic Zone (Planning Commission). The district has 107000.143 hectare net sown area, 82000.935 hectare area sown more than once and 190000.078 hectare gross cropped area. Overall the district crop intensity percentage is 177%. The major challenges faced by the district are floods, droughts, storms, insects and pests etc. which make the agriculture vulnerable to the high cost affair in terms of yield per hectare.The small and marginal farmers are hardly able to survive due to non-availability of institutional financial support.In fact there is farmers' dilemma which prevails in the district because they have developed thethinking that this profession will no more remain a profitable venture. The qualitative and timely inputs are not being used by most of farmers because of financial paucity and meagre technology.Few optimistic and progressive farmers have adopted the alternative farming such as organic vegetables, organic fertilizers, organic fruits etc. but the major challenges for them still prevails due to high cost of production as a result of which the marketing of those outputs are struggling to find the buyers.

The existing study has objectivesto evaluate the sustainability opportunities and threats in agriculture in the district andto realize the scope of organic/alternative agricultural practices in the district. Thisworkisthe outcome of exploration of secondary information mostly from the district and state statistical department. However, the cases of success and failure are being included after the self-observations and farm visits in the district. For comparison and causal effects few statistical tools are being used as it serves the purpose.

KEYWORDS: Sustainable Agriculture, Saharsa District, Organic Agriculture, Alternative Agriculture.

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1. INTRODUCTION:

Saharsa is one of the thirty-eight districts in Bihar. It became a separate district in 1954 prior to which it was a part of Kosidivision. Initially, Saharsa was the Bhagalpur Division. Saharsa town is the district headquarters of the district administratively. Saharsa district comprises two sub-divisions, namely Saharsa Sadar and Simri Bakhtiarpur which is divided into ten blocks; these are:1. Sonbarsa, 2.Saur Bazar, 3.Nauhatta, 4.SimriBakhtiarpur, 5.Kahra, 6.Salkhua, 7.Patarghat, 8.BanmaItahri.9.Mahishi and10.Sattar Kataiya, Total no. of Gram Panchayats in the district is 127, whereas the district has 227 number of revenue villages.

Historical Overview of the District:

Earlier Saharsa district belongs to Bhagalpur Division. On 2nd October 1972Kosi Division was formed, which in cludes Purnia and Katihar with Saharsa as headquarter. Similarly Birpur was created on 01.12.1972as new Civil Sub-Division comprising 24 Blocks viz. Previously under Supaul sub-division of this district, Raghopur, Chhatapur, Basantpur and Nirmali were the part. On 30.04.1981 and 14-03-1991Madhepura&Supaul (respectively)have been separated from Saharsa district. Saharsa district now consists; Saharsa Sadar and Simri Bakhtiarpur as2 subdivisions. There were 10 development blocks and anchals in the district. Saharsa is the divisional headquarters of Kosi Division which comprises three districts, namely, Saharsa, Madhepura and Supaul.

Saharsa is surroundedby few eminent districts of North Bihar. District SupaulandMadhubani bounded the district from north, on the south by the district of Khagaria, on the east by the district of Madhepura and on the west by the district of Darbhanga. Saharsa is the chief town being the district as also the headquarters of West Kosi Division. The status of district toSaharsa was given on April1st1954without any independent status and still few blocks of the district were in the districts of Munger& Bhagalpur. Major part of the district is stillsuffering from annual floods since ancient India. The sub terai of Saharsa district was recognized forpaddy cultivation which was on the mercy of the fickle moods of riverKosi. On the basis of these limited informationfrom the early history of the district may be restructures to preserve some important historical monuments in a few places.A portion of the district of Saharsa was in cludedina small Janpad, named Apna, in Anguttarap in ancient Vaishali (one the strongest republic).

There were some association with Budhism among Budhiagarhi, Budhnaghat, Buddhadi, Pitahahi and Mathai of Saharsa district. The legendry evidences of that timeconfirmed that Lord Mahaviraand Lord Budhavisited the district several times during their missionary travels and blessed with some important sermons during that.Anga and North Bihar (including Shaharsa) were the independent till the beginning of the 6th century B.C. The prosperity Anga declines later, although

for some time Magadhremained an integral part of Anga. However theAngawasconsidered as an independent Janpadof the time.It was Nandas and Mauryaswho brought the whole of Bihar under the authority of Magadhan rule, thustheMagadhanEmpire was growing rapidly.A board of 58 punch marked coins of theMauryan period was discovered from the Goroghatin the first decade of this century.LaterProf.R.K.Choudhary found the same type of coinsatFatuahain 1956. Among the vital historical monuments, aMauryan pillar at Sikligarh on the Banmankhi-Purnea Road and another in the Kishanganj Police Station. SaharsaDistrict was a border district even in those days, theMauryan rulers apparently took special care to guard its frontiers.There did not seem to major political change in the district because Sungas and Kanvas of Sahrsa district supplantedtheMauryans.

Demographics of Saharsa District:

General demographic features of the district are being demonstrated in the following table:

Table 1: Demographic Status of Saharsa district.

Description	2016	2001
Actual Population	**1,900,661**	**1,508,182**
Male	997,174	789,432
Female	903,487	718,750
Population Growth	**26.02%**	**33.03%**
Area Sq. Km	1,687	1,687
Density/km2	**1,127**	**895**
Proportion to Bihar Population	1.83%	1.82%
Sex Ratio (Per 1000)	**906**	**910**
Child Sex Ratio (0-6 Age)	933	912
Average Literacy	**53.20**	**39.08**
Male Literacy	63.56	51.66
Female Literacy	41.68	25.27
Total Child Population (0-6 Age)	**387,479**	**316,930**
Male Population (0-6 Age)	200,497	165,793
Female Population (0-6 Age)	186,982	151,137
Literates	**804,996**	**465,577**
Male Literates	506,374	322,163
Female Literates	298,622	143,414
Child Proportion (0-6 Age)	**20.39%**	**21.01%**
Boys Proportion (0-6 Age)	20.11%	21.00%
Girls Proportion (0-6 Age)	20.70%	21.03%

Agro-Climatic Features of Sahara District:

The main source of economy of the district Sahrsa is undoubtedly the agriculture. The main crops of the district are; Rice, Maize, Wheat, Lentil/ Pulses, Mustard and Gram. Saharsa is one of the biggest rice producing hubs in the north Bihar. The district is among the 36 districts in in the state, currently in the list of beneficiaries from the Backward Regions Grant Fund Programme. Saharsa with the geographical area of 93.60 lakh hectare, the district has 6.22 lakh hectare covered by the forest, 16.7 Lakh hectare land is used for non-agricultural purposes. There are 4.32 lakh hectare

identified as barren and non-cultivable land, whereas 0.45 lakh hectare land is considered to be the cultivable wasteland. The areas of net cultivatable purposes are being shown in the following table:

Table-2 – Net Cultivable Area

Area in Lac Hactare	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Net Area Sown	55.54	53.32	52.58	53.96	54.02	52.52	52.78
Total Cropped Area	76.71	72.96	71.94	76.46	77.78	75.8	76.73
Area Sown More Than Once	21.17	19.64	19.35	22.51	23.75	23.28	23.95

Table-3 -Sources of Irrigation

Name of District	Canal	Tube well	Other sources	Total irrigated Area
Saharsa	5527	84562	4894	94983

Source: Agricultural Profile of the State (Bihar) 2017-18

The above table clearly depicted that the percentage share of the production in agriculture is meagre from the district in comparison to entire state as well among the districts of 3rd zone of the state. But one thing is visible that the yield per thousand square yard is always either higher from the states or it is neck to neck to the states yield per thousand square yard.

2. LITERATURE REVIEW

Nasim Ahmad, K.M. Singh and D.K. Sinha (2018) conducted an Study entitled “Changes in land use pattern and factors responsible for variations in current fallow land in Bihar, India” in Indian Journal of Agricultural Research. ISSN: 0367-8245 /0976-058X, 52 (3) 2018: 236-242. In this paper theyanalysed that the factorsresponsible for changes in the land use pattern, especially increased in current fallows, reducing the net sown area and change ofnon-agricultural lands in the state.The concentration of current fallow lands wasconsidered in Gaya,Munger,Patna,Jehanabad, Purnea and Kishanganj districts. The rainfall and road length have signify cant impact on the level of current cultivation. Impulsive monsoon and labour paucity during the study period resulted enhancement of current unsown lands. The non-agricultural use of landwas recognized as theeminent factor for volatility in common lands as it affected the current cultivation negatively. It is challenging for the policymakersto enhancethe income of farmers from a declining in net sown area and unfavourable destructive climatic conditions as well as condition of labour paucity. To lift the production and the income of the farmers, it is necessary to control the current fallows or to bring current fallows under cultivation.

Kumari J. Aruna*, Rao P.C., Madhavi M., Padmaja G., (*17 July, 2018*) studied on"Effect of herbicides on the activity of soil enzymes urease in maize crop", published in Indian Journal of Agricultural Research in the Year: 2018, Volume 52, Issue 3rd,ISSN- 0367-8245 and0976-058X.Method of study was a field experiment to evaluate the effect of pre-emergence, post emergence and combination of atrazine with post emergence herbicides on soil enzyme urease activityat College Farm, Professor Jayashankar from College of Agriculture.As an experiment they laid out inRBD(Randomized Block Design) using six herbicide treatments un weeded control and hand weeding at 20 and 40 DAS with three replications. As a test crop maize was sown. The samples from the soilsat 15 days intervals: 0- 15-30-45- 60- 75 and 90 days were collected, to assay the enzyme activity. The pre-emergence herbicides were sprayed at zero days after sowing where post-emergence herbicides were sprayed after 15 days after sowing. From 0 days to 60 days the enzyme activity in the control increased and then decreased but the activity in the pre- emergence herbicide pendimethalin showed the same phase showed higher activity over the control at each stage where as atrazine showed decrease in activity at 0 days (8.71) and latter it revoked the activity and reached maximum at 60 days (12.35). The activity was less at each and every stage when compare to pendimethalin. In case of post – emergence herbicides the activity showed mixed responses to at different stages Tembotrione showed higher activity when compare to Topramezone. It showed mixed responses in combination of Tembotrione and Topramezone with atrazine.

Reddy M. Srinivasa*Swathi Y. M., and Reddy G. Prabhakara, Kavitha P. (***2017***.), Studied on"Influence of density, planting patterns and mulching on yield of-drip irrigated pigeonpea"Published in 'Indian Journal of Agricultural Research' Volume51, 6thIssue,ISSN - 0367-8245 &0976-058X. During late kharif season of the year 2016-17a field experiment at Agricultural College Farm, Mahanandi (Andhra Pradesh) was done to study the effect of density planting patterns and insulating on yield parameters of pigeonpea under drip irrigation. The study was laid out in block design which was randomized with nine treatments and three replications. The yield featured viz., pods branch:1, pods plant:1, seeds pod:1 pod yield plant:1, hundred seed weight and seed yield were maximum with 120/60 cm × 20 cm as paired rows with plastic mulch in pairs. Higher stem yield was noticed with spacing of 180/60 cm × 20 cm as paired rows with plastic mulch in pairs. Finally, the quantity of seeds pod-1 and hundred seed weight and harvest index of pigeonpea did not differ significantly among the treatments.

3. METHODS:

To evaluate the major issues and challenges of sustainable agriculture in Sahrsa District of Bihar, both evaluative and descriptive research methods are being used. The major conclusions are drawn from the evaluation of the secondary data collected from the several ministries and their

official websites. The real reactions from the farmers and the stakeholders came out of personal farm visits. Interview schedules and mini questionnaires are being used to understand and note the efforts, issues & challenges in sustainable agricultural practices in the District.The targeted samplings were used to collect the data from the 48 small & marginal farmers of Saharsa district. They were contacted vide interview schedules to fulfil the objectives of the research. Three null hypotheses are tested using action/live researches. General statistical tools are used as per requirements.Mostly descriptive statistics are being used in to extract and evaluate the results.

4. ANALYSES INTERPRETATIONS AND RESULTS:

It is being discussed in the methodology section thatfew farms were visited intentionally for the sake of finding out the scopes and status of the sustainable agriculture in the district. During the data analysis, specifically asked certain tricky questions to understand the viability in the field of agriculture. Few questions were asked to such as financial viability for the Rabby and Kharif crops for the farmers. The personal visit for the sake of spot observation were made and found that eventually it was a disguised engagement of the family members. Mostly the required manpower is far less than that they were involved in that particular piece of agricultural land. Moreover, the subtle change took place in last one and half decades that the new generation didn't find the agriculture as profit earning occupation. Thereby, they consider farming as support in the household management.

As we discussed in the methodology part that the investigation is done vide secondary sources majorly. Thus the farm visits are being considered as the primary source of data.

From the secondary data following table expressed the agricultural demography of the district. The table expressed the progress from 2010-11 to 2016-17.

The above table clearly indicates that the yield is up to the mark and sometimes it's better than the entire state yield. The yield performances are better than the state level of cash crops like Sugarcane, total food grains, Maize and Arhar are the major one. The case of Arhar production is little unfortunate for the district, in spite of high yield, the district is able to produce only 0.01% of the total state level production. The obvious reason for that is the 0.01% of also mentioned in the above table. It is quite strange that the district has no Gram production, while there is big scope. The sugarcane yield in the district is far better than the entire state whereas only 0.05% of net sown area of the entire state produces only 0.06% of the total state production.The district is reasonably good in the production of the '*Moong'*and'*Maize'* they are contributing 7.4% and 7.5% of the total state production.

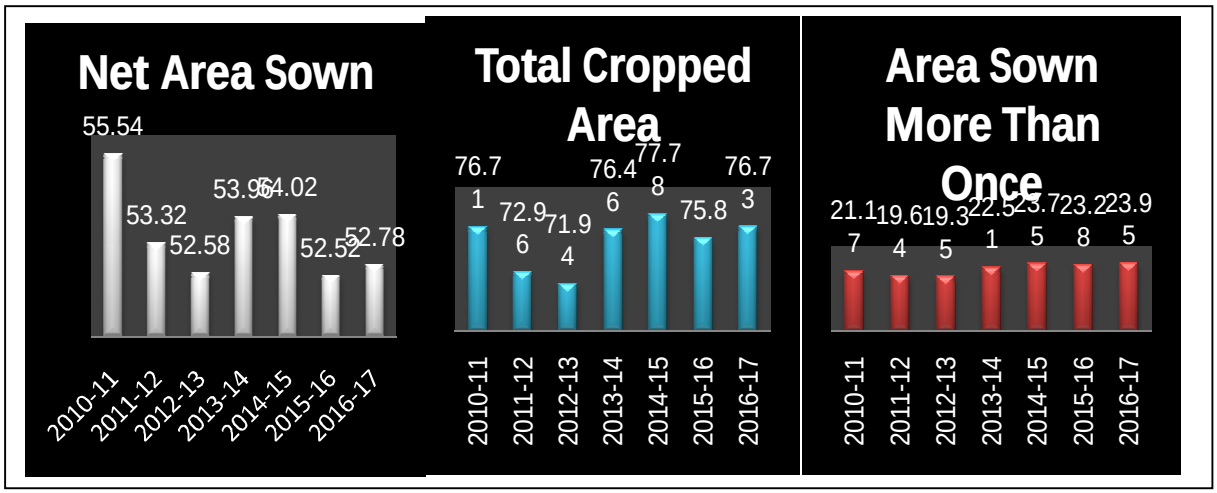
Table-4 -Production and Yield Major Crops (2016-17)

Crops	Area/Production/Yield	Saharsa	Bihar	Percentage
Rice	Area in Ha	85896	3554265	2.42%
	Production in MT	78172	4418174	1.77%
	Yield in Kg	910	1269	71.71%
Wheat	Area in Ha	42814	2161497	1.98%
	Production in MT	87215	5050539	1.73%
	Yield in Kg	2037	2337	87.16%
Maize	Area in Ha	31869	654772	4.87%
	Production in MT	132385	1752537	7.55%
	Yield in Kg	4180	2677	156.14%
Gram	Area in Ha	0	68781	0.00%
	Production in MT	0	66932	0.00%
	Yield in Kg	0	973	0.00%
Lentil	Area in Ha	931	162612	0.57%
	Production in MT	573	128956	0.44%
	Yield in Kg	615	793	77.55%
Moong	Area in Ha	18336	171818	10.67%
	Production in MT	9040	116923	7.73%
	Yield in Kg	493	681	72.39%
Arhar	Area in Ha	2	34298	0.01%
	Production in MT	2	34647	0.01%
	Yield in Kg	1000	1010	99.01%
Total Pulses	Area in Ha	22805	607519	3.75%
	Production in MT	12514	497170	2.52%
	Yield in Kg	549	818	67.11%
Total Food-grains	Area in Ha	184558	7042441	2.62%
	Production in MT	311523	11761436	2.65%
	Yield in Kg	1688	1670	101.08%
Mustard	Area in Ha	986	86172	1.14%
	Production in MT	577	81574	0.71%
	Yield in Kg	585	947	61.77%
Total Oilseed	Area in Ha	1877	140731	1.33%
	Production in MT	1484	137861	1.08%
	Yield in Kg	791	980	80.71%
Sugarcane	Area in Ha	58	108558	0.05%
	Production in MT	2144	3854925	0.06%
	Yield in Kg	36966	35510	104.10%

Source: Agricultural profile of the state, Bihar, 2016-17.

Table- 5 -Trends of agricultural practices in the district

Area in Lac Hactare	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Net Area Sown	55.54	53.32	52.58	53.96	54.02	52.52	52.78
Total Cropped Area	76.71	72.96	71.94	76.46	77.78	75.8	76.73
Area Sown More Than Once	21.17	19.64	19.35	22.51	23.75	23.28	23.95



Graph-1 -Trends of agricultural practices in the district

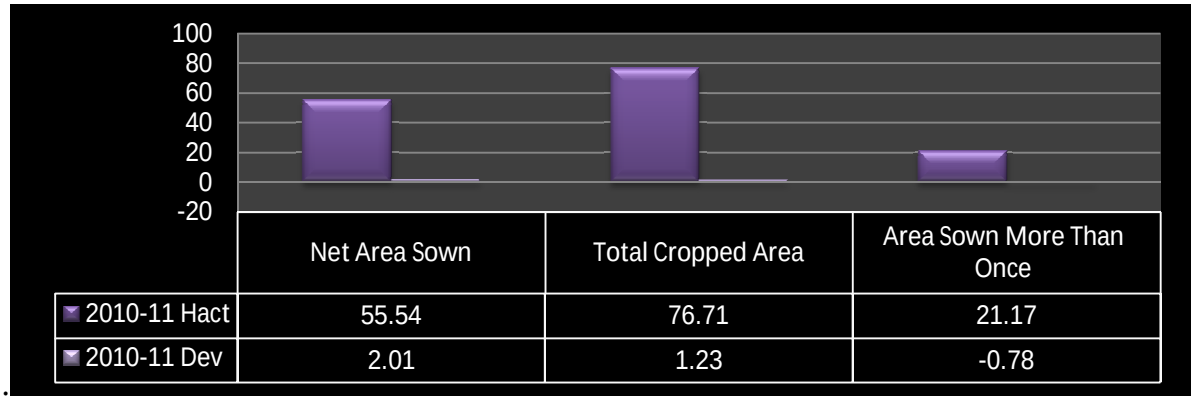
Overall Progress and Deviation:

The above discussion was crop wise particular status in 2016-17 in the district. Whereas the overall discussion of 'Net Area Sown. 'Total Cropped Area' and 'Area Sown More than Once'. In this study we tried to note down the changes during last 7 years in the district. We would be able understand the deviation from the analysis to find the stability or instability in the growth trends of cropping pattern in the district.

The above graphical presentation depicted the'Net Area Sown', 'Total Cropped Area' and 'Area Sown more than once' in Saharsa district since 2010 to 2017.

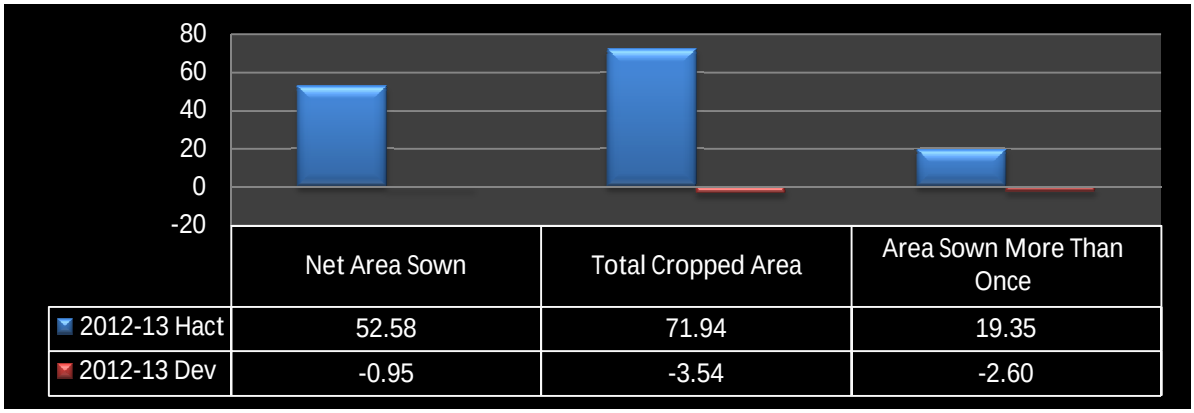
Table- 6 -Trends of agricultural practices in the district

Area in Lac Hactare	2010-11		2011-12		2012-13		2013-14		2014-15		2015-16		2016-17		Average
	Hact	Dev	Hact	Dev	Hact	Dev	Hact	Dev	Hact	Dev	Hact	Dev	Hact	Dev	
Net Area Sown	55.54	2.01	53.32	-0.21	52.58	-0.95	53.96	0.43	54.02	0.49	52.52	-1.01	52.78	-0.75	53.53
Total Cropped Area	76.71	1.23	72.96	-2.52	71.94	-3.54	76.46	0.98	77.78	2.30	75.8	0.32	76.73	1.25	75.48
Area Sown More Than Once	21.17	-0.78	19.64	-2.31	19.35	-2.60	22.51	0.56	23.75	1.80	23.28	1.33	23.95	2.00	21.95

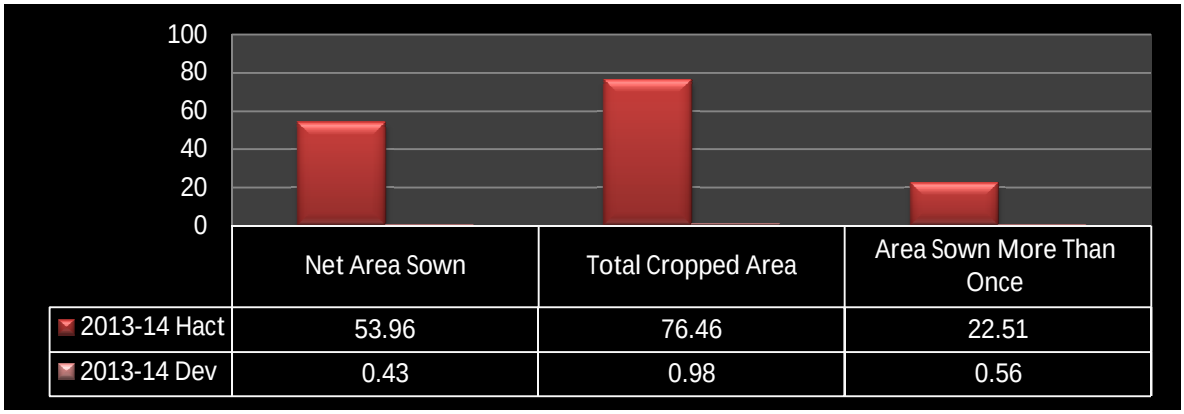


Graph-2 -Trends of agricultural practices in the district

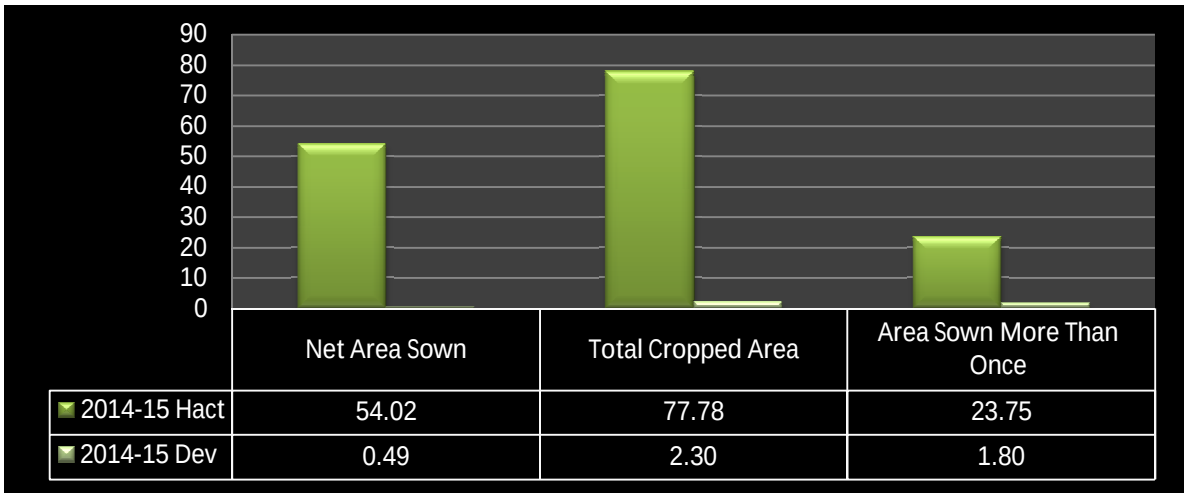
Graph-3 -Trends of agricultural practices in the district



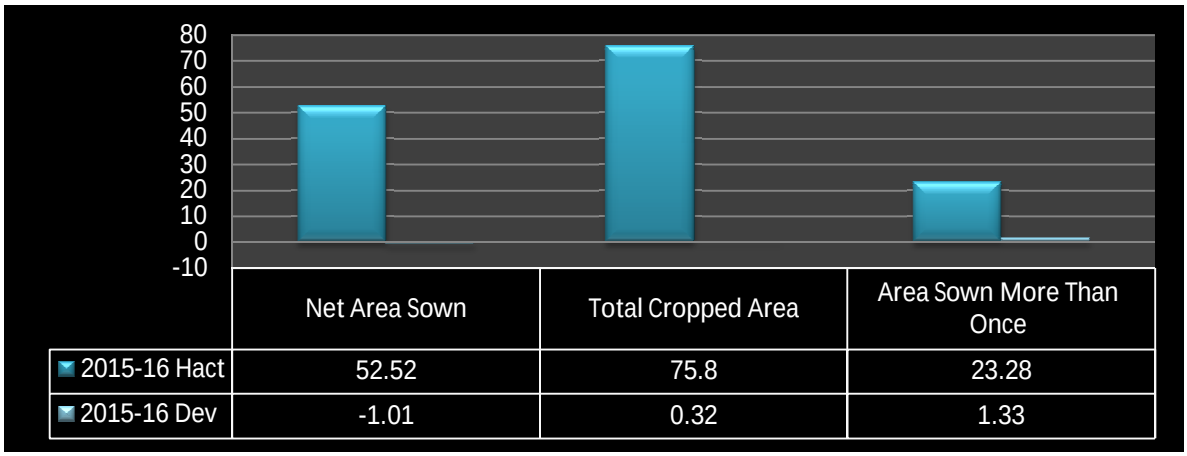
Graph-4 -Trends of agricultural practices in the district



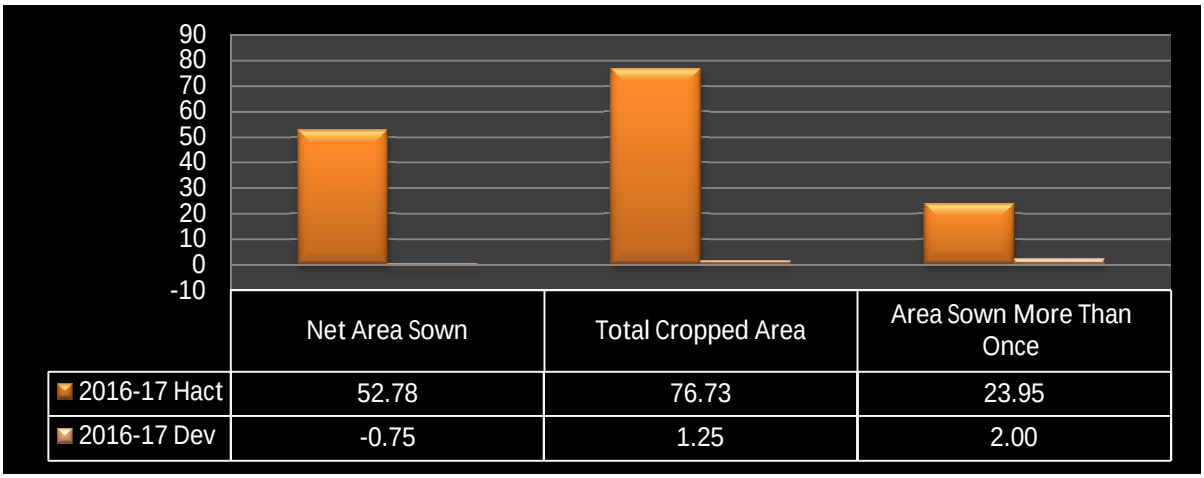
Graph-5 -Trends of agricultural practices in the district



Graph-6 -Trends of agricultural practices in the district



Graph-7 -Trends of agricultural practices in the district



Graph-8 -Trends of agricultural practices in the district

From the above tabular and graphical presentation, it is quite clear that Net Sown Area and the Total Crop Area are been declined through the 7 years,only the third indicator the Area Sown More than Once has shown the increasing trends.

The Sustainable Aspect:

From the farm visits and one to one interaction with the farmers it is quite obvious that the district is far away from the awareness of sustainability especially in the agricultural practices.Though there are some glimpses of organic agriculture in the district. We shall admire the story of a banker who adopted organic farming by his choice.

Mr.Barun Singh said, “Farming is fascinating, provided it requires continuous hard-work and devotion without any distraction”. Avermi-composting unit in a portion of his ten acres of land is been maintained by him, and to cater that Mr. Barunhad one dairy unit attached for composting unit so that the cattle dung can be easily utilized for the process without much labour involvement. He usually used the waste materials such as rotten vegetables, dried leaves,fruits etc.are spread over a sheet on the ground covered with cattle dung. Several Pakkatanks with small holes using bricks and cementwere made for easy movement of earthworms from tank to tank, and then effective collection of vermi-wash took place.

Net profit-The High Density Planting (HDP)**:**

According to Mr.Aditya, an (agricultural Scientist), “The farmer made a net profit of Rs.12 lakh from his multi-unit alone including sales of above Rs. 25 lakh in the States of Bihar and Jharkhand together with supplies to the government in 2016 and in the current year, he expects a net profit of Rs.15 lakh,becausethe demand for organic inputs in the surroundings is quite high.” For the cultivation of tissue culture banana usingHigh Density Planting (HDP) techniqueMr.Barun maintained a two-acre farm exclusively. He said that, “Growth of even two months old plants better than the normal banana cultivars planted at the same time in other plots.” High Density Planting (HDP) is an effective advance techniqueused to multiply the fruit yield. In this technique, about 4,000 -5,000 plants can be planted in one hectare, as a result of which the yield increasessignificantly. As per Mr. Aditya, “this technique is more useful for recurrent crops because it allows efficient use of land resources”.The HDP experiencedenhanced yield resulting high profit, tranquil canopy managementfor the better mechanization of farm in the Saharsadistrict.The district is also use to theefficient spray, cultural practicesand weed control which resulted to the improvement in fruit quality easy and good harvests.The HDP technology has been successfully used in banana, pineapple, papaya and mango, guava and citrus, where the yield has increased two to three times in the district.

Sustainability of Agro-Marketing:

In Sahrsa district, the agricultural produce in the form of vegetables of different farms,packed and sent to local market as well as in different parts of the state. Most of the farmersownaoil extracting plants for mustard processing.Moreover,the mustard bran are used as a nutritious concentrate for cattle. Mr. Adityasiad, "the success of an agricultural research programme or project must be on increasing productivity and income to the small famer." Further he added,"the farmer was conferred the best Innovative Farmer Award by the university last year for his sustained efforts and leadership qualities in guiding other farmers in the region."

5. CONCLUSION SUGGESTION AND RECOMMENDATIONS IN THE TRAP OF DISGUISED AGRICULTURAL PRACTICES:

While concluding the above discussion it is quite clear that the sustainability aspect in the agriculture is not found but obviously the craze for the alternative farming is started taking baby steps in the district. Since agriculture is the major occupation in theSaharsa district and paddy is the main crop. The district is famous for its Lichi (summer berry) and the varieties of Mango's. Moreover the district is famous for Makhana (fox nuts) cultivation in the flood plains of Kosi River which is the most important cash crops.Often floods created huge impact with large-scale heap and desolation in Supaul, Saharsa and Madhepura districts, causing huge property and life loss along with the loss in agriculture. As a result of this the water table exposed in a small pit of hardly 1.5 meter deep during November inthe district. The people in the villages of Saharsadistrict depends upon groundwater for their domestic supply, including drinking water. Dug wells are frequently met in every village, but presently most ofthem are not in use unlike many other parts of the Bihar state. Since last decade and half, the lives of the district have got a more easy way to access the groundwater by auguring a hole up to 5–7 meter and putting a locally designed hand pump assembly into that. Bamboo is also used as the hand pump assembly pipe in many cases.

In the district (the study region), there are four cropping seasons prevalent:

1) *Garma (March-June),*
2) *Bhadai (April/May – August/Sept.),*
3) *Aghani (June- November),* and
4) *Rabi December- March).*

Two seasons, Bhadai and Aghani are clubbed for all practical purposes as Kharif season. Actually, the staple cereal of this district is rice. As the matter of fact the principal crops grown during different seasons are produced in the following table:

Table:7 -Agricultural seasons and major crops in Saharsa district, Bihar.

Season	Kharif	Rabi	Garma
Crops	Paddy, Maize, Pulses, Fiber	Maize, Wheat, Pulse	Paddy, Maize, Moong

The district has a very rich and fertile land which is favourable for agriculture. Rice, Maize, Wheat, Lentil/ Pulses, Mustard and Gram are the main crops of the district. Saharsa is famous and having edge of producing the varieties of '*Moong Daal'* (*lintels*) and Summer Berry known as Litchi.

The major conclusions that can be noted down out of this study are:

1) District is fertile, rich and water prone for agricultural practices.
2) High levels of yield are being found especially in case of Maize, Arhar and MoongDaal.
3) There are huge scopes for agricultural sustainability in the district.
4) There are certain farmers who are motivated towards alternative agricultural practices.
5) The district has big threats of floods as well as draught as a major agent for crop damages.
6) The crops are fully prone to the insects and pests, which required insecticides and pesticides use in the crop protection.
7) The district has enough institutional finance support as well as non-institutional financiers are also prevailing with strong roots.

Suggestions and Recommendations:

In the light of above discussion, following suggestions would be appropriate for agriculturists and the related stakeholders:

1) It would be dramatic change if the economic aspect if the farmers switch from the regular cereals to the cash crop pattern.
2) The farmers should calculate the cost and benefit of the agricultural practices in the district.
3) It is often found that the farmers hardly even realized about economic cost i.e. they only calculate the accounting/implicit costs. They should always calculate the economic costs/explicit costs.
4) The policy makers shall implement the crop insurance, Kisan Credit Card and Agricultural Finance with proper vigilance in the district. They should make sure that these schemes and financial helps shall be used in the economic/agricultural activities only.
5) The farmers shall minimize the harmful inputs such as insecticides, pesticides and other related chemicals to enhance the sustainability in the agricultural fields.

6) Every time the farmers supposed to use increased quantity of urea, DAP, Potassium and other related fertilizers to maintain the yield. Thus it is recommended that they should consistently reduce and avoid the use of chemicals for agricultural sustainability.

Finally, Saharsa district has immense potential for the sustainable agricultural practices. The farmers should compromise with the yield by reducing the fertilizers, insecticides, pesticides and other hazardous inputs. That will simply save the fertility of the agricultural fields.

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