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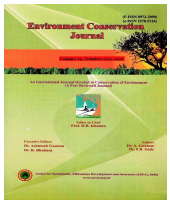

Comparative evaluation of low-cost natural farming, organic farming and conventional farming in major crops of South Saurashtra region at Junagadh, Gujarat, India

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ABSTRACT

Conventional farming always modifying by good innovation in agriculture, while the holistic idea of organic farming checks the use of synthetic inputs where in opposite side, the concept of natural farming allowing farming with few traditional and locally available inputs. The all three farming concepts are fundamentally different, to check it on real field, a experiment was conducted on medium black calcareous clayey soil at Junagadh (Gujarat) during *rabi* 2019-20 to *kharif* 2020 in order to evaluate low cost natural farming, organic farming and conventional farming in major six crops of Gujarat. The experimental results revealed that conventional farming module significantly increased yields of crops as compared to organic farming and low cost natural farming. Significantly higher available nitrogen, phosphorous and potassium after harvest was found under conventional farming, while organic farming module registered significantly higher organic carbon, heat soluble S; DTPA-extractable Fe, Zn, Cu and Mn after harvest, which was found at par with conventional farming. Economic analysis showed that maximum net returns gross returns, and B:C ratio were observed under conventional farming module.

Introduction

Since human evolution, farming practices concept has been changing with new innovations and connectivity with other continental peoples. the concept has totally changed from its core ideas, which is also favourable in point of meet the current demand form society. that point of view conventional farming walk with innovations. During 19th century and earlier time farmers of thorough world of are capable to meets the demand of food by producing food in organic farming. In current scenario, growing organic food was no longer a viable way to feed the world's population as the world's population grew. As a result, advancements and technology were introduced innovative, resource efficient and sustainable productive ways to feed a population that had nearly doubled in size. Mechanized farming, fertilizers, and chemically pest control system have contributed to higher yields for a larger population. These farming methods became ingrained in what we now refer to as "conventional" farming (Melissa, 2003).Green putsch transformed the country from a food-deficit state to self-sufficiency during early 1970's but the avails of green putsch were reviewed and found that it has led to serious negative impacts on genetic diversity, incidence of pests, soil erosion, soil fertility, water shortage, micronutrient deficiencies, soil contamination, and availability of nutritious food for the local population. Ultimately farming society of the Indian has been experiencing rural impoverishment the displacement of huge numbers of small farmers from their land and increased tensions and disputes (Sebby, 2010).Government of India has committed

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to double farmers' income by 2022 and all efforts are being made to execute the pledge. After perceiving the harmful effects of chemical farming, newly introduced agriculture farming technique among the farmers is Low Cost Natural Farming means for all the crops, thereby decreased in the cost of production. The economic survey of 2018-19 made fervent appeal for adoption of Low Cost Natural Farming (LCNF) in a big way to double farmer's income and it was subsequently endorsed by the Hon'ble Finance Minister during her budget speech in the parliament. Organic farming, Biodynamic farming*, Homa Jaivik Krishi, Rishi Krishi, Panchagavya Krishi,* Natural farming, Permaculture, LEISA farming, Natueco farming, *Homa* Farming, *Yogic* farming and other eco-friendly and farmer-friendly alternative farming systems are based on nature and implemented to protect soil and environment degradation, protection from the hazardous side effects of chemical methods, such as magnification, pollution, carcinogenic elements, food poisoning and so on.

In Current scenario,scientific community, ecologist, policy makers and economist making special affords to reduce the environmental burden of agricultural productionand direct it toward more sustainable practices.To serve the purpose we have conducted comparative study between CF, OF and LCNF. It is first study in Indian continent to check the available resource efficiency and economical output of fundamentally different agricultural practices

Material and Methods

Our research study was conducted on non-organic fixed plot with large plot technique and five samples collected from each of 2.7 m x 4.8 m plot. The observations were recorded on five randomly selected plants for each net plot and mean values were computed for each net plot and mean of all the plots represent the result of each module. Some of the parameters were analysed in the field immediately after collection of samples. Soil samples were directly taken in the lab and analysed for various soil physico-chemical parameters like, bulk density, porosity, water holding capacity, organic carbon (walkley and black's process), available nitrogen (Subbiah and Asija, 1956), available phosphorus (Olsen *et al.*, 1954), available potassium (Jackson, 1974), available sulphur (Williams and Steinbergs, 1959) and micronutrients (Lindsay and Norvell, 1978). The details of the farming module are presented in Table 1. The present experiment included wheat and chickpea during *rabi* season 2019-20; groundnut and sesame during summer season 2020; groundnut and sweet corn during *kharif* season 2020. Only Module-I (Low cost natural farming) included intercropping of wheat and chickpea (4:1 replacement series); groundnut and sesame (3:1 replacement series); groundnut and sweet corn (2:1 replacement series). The detail technical programme presented in Table 2. For data analysis, the experiment has followed Large plot technique model.The benefit:cost ratio was calculated by using the following formulae.

$$\text{B:C} = \frac{\text{Gross returns (₹/ha)}}{\text{Total cost of cultivation (₹/ha)}}$$

Table 1: Package of various treatments of different farming systems

Treatments	Module details
Module-I	**Low cost natural farming (LCNF)** • Intercropping of crops • Seed treatment with *Beejamrut* by spraying on seed, mix well and dry before sowing • Soil application of *GhanJeevamrut* @ 250 kg/ha along with FYM @ 250 kg/ha at sowing as well assoil application of *Jeevamrut* with irrigation at sowing, 30, 60 & 90 DAS • *Achhadan*: Wheat straw mulch @ 5 t/ha • Plant protection: *Agniastra*, *Brahmastra, Neemastra*, *etc.,* if required
Module-II	**Organic farming (OF)** • Sole cropping of crops as per area covered in LCNF • Seed treatment with biofertilizer by spraying on seed, respectively; mix well and dry before sowing • Soil application of vermicompost @ 2 t/ha, FYM and foliar application of *Panchagavya*at 30, 45 and 60 DAS • Plant protection: Pheromone trap, *Trichoderma*, *Beauveria*, *Metarhizium*, NPV, *etc*., if required
Module-III	**Conventional farming (CF)** • Sole cropping of crops as per area covered in LCNF • Seed treated with recommended fungicide before sowing of seed • Soil application of recommended dose of mineral fertilizer (Urea and DAP) and manures (Farmyard Manures) • Plant protection: Recommended fungicides, insecticides and herbicides, if required

Table 2: Technical programme of present experimentation

Season-1	***Rabi***	
Crop and variety	Wheat, GJW 496 (Wheat Research Station, Junagadh)	Chickpea, GG 5 (Main Pulse Research Station Junagadh)
Spacing	22.5 cm	45 cm × 10 cm
Seed rate	100 kg/ha	60 kg/ha
Manures and fertilizer	FYM 10 t/ha 120-60-60 kg N-P-K/ha	FYM 5 t/ha 20-40-0 kg N-P-K/ha
Season-2	**Summer**	
Crop and variety	Groundnut, GJG 31 (Oil Seed Research Station Junagadh)	Sesame, GJT 5(Oil Seed Research Station Junagadh)
Spacing	30 cm × 10 cm	30 cm × 10 cm
Seed rate	100 kg/ha	3 kg/ha
Manures and fertilizer	FYM 10 t/ha 25-50-50 kg N-P-K/ha	FYM 5 t/ha 50-25-40 kg N-P-K/ha
Season-3	***Kharif***	
Crop and variety	Groundnut, GJG 22 (Oil Seed Research Station Junagadh)	Sweet corn, Sugar 75 (Collected form privet vendors of seeds, "Syngenta")
Spacing	60 cm × 15 cm	60 cm × 20 cm
Seed rate	120 kg/ha	12 kg/ha
Manures and fertilizer	FYM 7.5 t/ha 12.5-25-25 kg N-P-K/ha	FYM 5 t/ha 120-60-60 kg N-P-K/ha

FYM – Farmyard Manure

Study area

The experiment was set up at western state of India (Gujarat) at Instructional Farm, Department of Agronomy, JAU, Junagadh, for the period agricultural year 2019-20.The land from of Southern Saurashtra region of Gujarat have developed from basaltic and Gaj bed milliolitic lime stone parent materials from hill slope to piedmont and alluvium in piedmont plain and coastal plain. The soils have clay loam to clayey in texture, moderate to strong sub angular blocky structure and very dark greyish to brown colour. Before starting the experiment, soil chemical parameters shows that the soil of the plot was calcareous and slightly alkaline in reaction with pH 8.34, 7.97 and 7.74 and EC 0.54, 0.50 and 0.47 dS/m in *rabi* 2019-20, summer 2020 and *kharif* 2020, respectively. The soil was low in available nitrogen (239.88 kg/ha, 236.39 kg/ha and 242.32 kg/ha), medium in available phosphorus (32.14 kg/ha, 32.48 kg/ha and 34.77 kg/ha) and medium in available potassium (254.06 kg/ha, 249.51 kg/ha and 254.11 kg/ha) in *rabi* 2019-20, summer 2020 and *kharif* 2020, respectively.This region comprises of arid and semi-arid type of climate with average annual rainfall widely varied from 400-800 mm. Junagadh located at the periphery boundary of south west monsoon.

The mean maximum and minimum temperatures during *rabi* 2019-20 ranged from 25.4 to 34.3 °C and 9.7 to 19.4 °C, respectively, during crop growth and development. During crop period the relative humidity was in the range of 56 to 80%. There were no occurrences of winter rainfall during life span of crops. During the crop growth and development cycle in summer 2020, the mean maximum and minimum temperatures were 31.6 to 42.4 °C and 16.9 to 27.7 °C, respectively. Average relative humidity was varied between 24.25 & 33.65% and no rainfall during the period. The meteorological parameters for the period of investigation during *kharif* 2020 includes maximum and minimum temperature range from 28.6 to 36.9 °C and 24.5 to 26.7 °C, respectively. The relative humidity ranged from 83 to 96% during crop period. Total rainfall received during crop growing season was 60 mm.In the experiment we have just included only major cropping system of Junagadh, Gujarat, the comparative evaluation can be strengthen by including diverse spectrum of crop with different agro ecological conditions.

Preparation of bio-enhancers

Beejamrut, Jeevamrut, Ghan Jeevamrut and Panchagavya used in present experiment was prepared on farm by using following ingredients (Bisnoi and Bhati, 2017). Till date, there is not standard evolution of major component for the ingredients.

Beejamrut

Beejamrut, an organic, was used to treat seeds prior to sowing in order to improve germination and protect young roots from fungi, as well as soil-borne and seed-borne diseases. Local cow dung- a powerful natural fungicide, cow urine- a potent anti-bacterial liquid, lime, water, and soil are among the ingredients.

Jeevamrut

In the plant system*, Jeevamrut,* an organic product, has the ability to promote growth and provide immunity. *Jeevamrut* is made up of four different ingredients: cow dung, cow urine, chickpea flour, and jaggery. These have miraculous effects when properly combined and used.

Ghan Jeevamrut

Ghan Jeevamrut is dry or solid *Jeevamrut* that acts as a natural fertilizer for the crop plants. *Ghan Jeevamrut* prepared from desi cow dung, cow urine, jaggery and pulse flour.

Panchagavya

Panchagavya is a Sanskrit word that means "five cow items." The fermentation process uses five cow products, as well as a few other natural ingredients, as the name implies. It is important to note that all cow products must come from a desi cow. Cow dung, cow urine, milk, curd, jaggery, ghee, ripe banana, tender coconut, and water were used in the experiment to make *Panchagavya.* When suitably mixed and used, these have miraculous effects.

Results and Discussion

Yields

In the comparative evaluation, in the *rabi* season, results showed that various farming modules manifested considerable influence on crop yields (Table 3). Remarkably higher grain yield (4930 kg/ha) and straw yield (6704 kg/ha) of wheat were recorded under conventional farming in comparison to organic farming and significantly the lowest wheat yields were recorded under low cost natural farming. The result was supported by long term experiment study as well as divers cultivars of wheat in all wheat growing continent under the similar treatment condition.(Mäder *et al* 2007, Kitchen *et al* 2003, Van Stappen et al 2015, De Ponti *et al* 2012 and Fagnano *et al* 2012) In the case of chickpea the numbers revealed thatdifferent farming modules had a substantial impact on yields (Table 3). In the conventional farming recorded higher chickpea seed yield (2415 kg/ha) and stover yield (3609 kg/ha), which was statistically at per to the organic farming module. On the contrary, the Module-I (LCNF) recorded the lowest seed yield (1737 kg/ha) and stover (2794 kg/ha) of chickpea. Which is supported by De santis 2021 study on chickpea. Glimpse of the data on groundnut yields differed significantly among different modules (Table 4). Impressively the highest pod yield (3027 kg/ha) and haulm yield (3837 kg/ha) was recorded CF, which was found at par with the organic farming of to the tune of 2830 and 3586 kg/ha, respectively and the LCNF recorded significantly lowest yields of groundnut. The data presented in Table 6 revealed that 100CF significantly promote the seed yield (1233 kg/ha) and stalk yield (1898 kg/ha) of sesame, succeeded by module OF and followed by LCNF.In *kharif* season, the concerned data (Table 5) indicated that different farming modules significantly influenced the haulm yield and pod yield during the research year. A critical scanning of the data showed that strikingly higher pod yield (1759 kg/ha) and haulm yield (2415 kg/ha) was recorded with whole package of conventional farming practices (CF), which was found statistically at per with to 100% nutrition through bio fertilizers, vermicompost, FYM and *Panchagavya* as well as biopesticides (OF) and *Beejamrut*, *Jeevamrut*, *Ghan Jeevamrut,* FYM, *Achhadan, Agniastra*, *Brahmastra* and *Neemastra*(LCNF) recorded significantly lowest pod yield of (1298 kg/ha) and haulm yield (1821 kg/ha) of groundnut. The data about yields of sweet corn are presented in Table 9 revealed that impressively maximum green cob yield (6802 kg/ha) and green fodder yield (18143 kg/ha) was recorded under the Module-III that included supply of mineral fertilizers along with FYM and pesticides (CF), followed by organic farming (OF) and significantly the lowest yields was analyzed under the module that included growing of crops with cow based bioenhancers, botanicals and FYM (LCNF).Yield potential is a complicated function of biochemical and metabolic processes occurring in a plant system, which can be influenced by the environment and appropriate crop cultivation practises. The highest grain yield of crop recorded with the supply of inorganic sources of nutrient due to the availability of nutrients and immediate release as compared to organic source of nutrient, which release the nutrient slowly (Banik and Sharma, 2009).Therefore, combined use of inorganic and organic sources of nutrients could be resulted of the better synchrony of nutrient availability (Mwale *et al*., 1997) that would be reflected in higher total yield and nutrient use efficiency. Higher yield of chickpea and groundnut was due to beneficial effect of conjunctive use of organic and inorganic supplements which increased the availability ofnutrients considerably resultingin improvement of nodule development, energy transformation, metabolic process and root growth causing more dry matter production and number of

Table 3: Yields of wheat and chickpea under low cost natural farming, organic farming and conventional farming (*Rabi*)

Particulars	LCNF	OF	CF	S.Em.±	C. D. at 5%	C.V.%
Wheat						
Grain yield (kg/ha)	3123	3983	4930	96	296	11.98
Straw yield (kg/ha)	4453	5481	6704	140	433	12.66
Chickpea						
Seed yield (kg/ha)	1737	2257	2415	54	166	12.58
Stover yield (kg/ha)	2794	3377	3609	86	266	13.26

LCNF – Low cost natural farming; OF – Oganic Farming; CF – Conventional Farming

nodule (Chaturvedi*et al*., 2010) These results are in accordance with findings of Chaurasia*et al.* (2014), Manjunatha*et al*. (2009), Jat*et al*. (2013), Baskar *et al.* (2017), Chaudhary *et al*. (2017), Pradeep *et al*. (2018) and Sikka *et al.* (2018).

Green Revolution transformed the country from a food-deficit state to self-sufficiency during early 1970's. The Green Revolution technology aimed to boost agriculture production by replacing conventional hardy crop varieties with high response varieties and hybrids, increasing fertiliserand plant protection chemical use, putting more cultivated land under irrigation, particularly through large investments in major irrigationsystems and consolidating land holdings to make agriculture amenable for mechanization. The initialresponse to these technological innovations was very dramatic and it resulted in quantum jump in agricultural production.

Post-harvest soil status

By just seeing yield results of single year we cannot conclude the whole farming system potential, another dimension we have evaluated the major element of agricultural production system in the form of post harvest soil status. In the time of *rabi* season, the data refer to the effect of variousmodules on physical properties of soil were furnished in Table 6. When looking about different modules, none of them exerted significant impacton bulk density, porosity and water holding capacity of soil after harvest of crops. An assessment of the data (Table 6) mentioned that different crop growing modules taken under experimentation exerted considerable influence on of soil available nutrients after harvestof the crops.Appreciably the highest available N, P and K after harvest of wheat and chickpea were recorded underthe conventional farming module (CF), while, module-II that included application vermicompost, FYM and *Panchagavya* (OF) significantly increased organic carbon, heat soluble S; DTPA-extractable Fe, Zn, Cu and Mn, which was statistically comparable to application of 100% RDF through fertilizers along with FYM (CF). Nevertheless, significantly the lowest available micro, macro nutrients and organic carbon after harvest of wheat intercropped with chickpea was recorded under the LCNF.

During summer season, the critical scanning of the data presented in Table 7 indicated that various farming modules like, low cost natural farming, organic farming and conventional farming had no significant impact on porosity, water holding capacity and bulk density after harvest of groundnut and sesame. The close look to the data on post-harvest chemical properties data in Table 7 indicated that considerably the highest available nitrogen, phosphorus and potassium were reported with approved dose of chemicals for plant nutrition and management of weed, insect-pests and diseases (CF). Module-II that included treatment of biofertilizer, vermicompost, FYM, *Panchagavya* and biopesticides (OF) having highest organic carbon (0.611%), S (19.606 mg/kg), Fe (5.429 mg/kg), Zn (0.635 mg/kg), Cu (0.287 mg/kg) and Mn (13.530 mg/kg), statistically followed by conventional farming (CF) and notably the lowest organic carbon and available nutrients was recorded with the natural farming module (LCNF).The data furnished in Table 8 illumined that effect of varied modules on porosity, bulk density and water holding capacity later the harvest of crop was significant during the study due to residual effect of previous season. It is explicit from the data that significantly the lowest bulk density after harvest (1.334 Mg/m^3); and maximum porosity (48.989%) and water holding capacity (44.586%) was recorded with organic farming (OF), which was found at par with conventional farming (CF). An evaluation of the data (Table 8) mentioned that different crop growing modules taken under experimentation exerted serious influence on post-harvest available nutrients in soil. Significantly the highest available

N (140.17 mg/kg), P (23.47mg/kg) and K (147.40 mg/kg) after harvest was recorded with use of 100% RDF + FYM and pesticides (CF). OF recorded significantly highest organic carbon, S, DTPA-extractable Fe, Zn, Cu and Mn, which was found at par with CF. Nevertheless, notably the lowest organic carbon and available nutrients after harvest was observed when crops grown under the LCNF.The results showed that during first and second season of experiment, non-significant improvement in porosity, bulk density and water holding capacity. But continuous supply of FYM in the Module-III and vermicompost along with FYM in the Module-II improved physical properties of soil. This was possible because of enrichment of soil organic matter resulting in aggregation of soil particles and good pore geometry in soil, reduced bulk density; increased porosity and water holding capacity. The findings confirm the reports of Brar *et al.* (2015). Organic additives, such as FYM and vermicompost, control soil fertility in agricultural systems. The addition of organic manures to agricultural soil has a number of effects on enzyme activity, which are critical for nutrient mineralization (Gopinath *et al*., 2008).The higher available nutrients and organic carbon in soil after harvest in the CF and the OF due to addition of more organic matter and production of organic acids and carbon dioxide released during the process of decomposition of FYM which improve the availability of nutrients from native supplied with help of fertilizers during crop cycle(Mere *et al*., 2013). Vermicompost itself contains more quantity of micronutrients and also increase available cationic micronutrient concentration in soil solution by soil microbes. Poorer results under the natural farming might be due to addition of smaller quantity of supplements. Similar results were also reported by Katkar*et al.* (2011), Sudhakaran*et al*. (2013), Arbad*et al.* (2014), Nagar (2017), Sikka *et al.* (2018), Jadhao*et al*. (2019) and Kumar *et al*. (2020). Many experts in the field of agriculture have voiced concern that any more efforts to persist with this model of chemical agriculture will only prove counter productive in the long run and cause irreparable damage to soil health and environment. Restoring soil health by reverting to non-chemical agriculture has assumed great importance to attain sustainability in production.

Economics

As earlier mentions, the experiment was conducted in conventional farming plot, that's why we haven't consider premier price for LCNF and OF, but after conversion period production form OF and LCNF should get higher prices. The findings of *rabi* season presented in Table 9 shows that maximum gross returns (USD 1354.33/ha), net returns (USD781.79/ha) and B:C ratio (2.37) were accrued with conventional (CF) due to sufficiently supply of essential nutrients and proper pest and disease control helps get higher output as compared toorganic (OF) and cow based supplements (LCNF).

Table 4: Yield of groundnut and sesame under low cost natural farming, organic farming and conventional farming (Summer)

Particulars	LCNF	OF	CF	S.Em.±	C. D. at 5%	C.V.%
Groundnut						
Pod yield (kg/ha)	2137	2830	3027	71	219	13.34
Haulm yield (kg/ha)	2789	3586	3837	92	284	13.52
Sesame						
Seed yield (kg/ha)	769	1008	1233	25	77	12.48
Stalk yield (kg/ha)	1197	1558	1898	42	131	13.67

Table 5: Yield of groundnut and sweet corn under low cost natural farming, organic farming and conventional farming (*Kharif*)

Particulars	LCNF	OF	CF	S.Em.±	C. D. at 5%	C.V.%
Groundnut						
Pod yield (kg/ha)	1298	1647	1759	40	125	12.89
Haulm yield (kg/ha)	1821	2273	2415	60	185	13.81
Sweet corn						
Green cob yield (kg/ha)	4543	5651	6802	147	451	12.93
Green fodder yield (kg/ha)	12578	15402	18143	418	1287	13.58

Table 6: Physical and chemical properties of soil under low cost natural farming, organic farming and conventional farming (*Rabi*)

Particulars	LCNF	OF	CF	S.Em.±	C. D. at 5%	C.V.%
Bulk density (Mg/m³)	1.474	1.451	1.464	0.016	NS	5.48
Porosity (%)	44.494	45.115	44.656	0.495	NS	5.53
Water holding capacity (%)	41.128	41.453	41.361	0.485	NS	5.87
Organic carbon (%)	0.485	0.547	0.529	0.007	0.021	6.60
Available N (mg/kg)	114.94	118.34	130.38	3.586	11.05	7.59
Available P(mg/kg)	14.73	16.34	18.89	0.570	1.76	8.78
Available K (mg/kg)	121.25	124.88	137.72	3.827	11.79	7.67
Available S (mg/kg)	16.120	18.275	17.982	0.265	0.817	7.59
Available Fe (mg/kg)	4.503	5.124	5.031	0.075	0.232	7.71
Available Zn (mg/kg)	0.506	0.586	0.558	0.009	0.028	8.31
Available Cu (mg/kg)	0.218	0.258	0.253	0.004	0.014	9.19
Available Mn (mg/kg)	10.939	12.645	12.167	0.200	0.615	8.37

N – Nitrogen, P– Phosphorus; K –Potassium; S – Sulphur; Fe – Iron, Zn – Zinc; Cu – Copper; Mn – Manganese

Table 7: Physical and chemical properties of soil under low cost natural farming, organic farming and conventional farming (Summer)

Particulars	LCNF	OF	CF	S.Em.±	C. D. at 5%	C.V.%
Bulk density (Mg/m^3)	1.463	1.406	1.433	0.016	NS	5.49
Porosity (%)	44.854	46.629	45.742	0.555	NS	6.07
Water holding capacity (%)	41.240	42.842	42.081	0.406	NS	4.83
Organic carbon (%)	0.506	0.611	0.584	0.009	0.028	8.12
Available N (mg/kg)	116.34	120.57	135.88	4.144	12.77	8.55
Available P(mg/kg)	15.30	17.22	20.97	0.606	1.868	8.72
Available K (mg/kg)	122.03	126.60	142.31	4.545	14.01	8.94
Available S (mg/kg)	16.647	19.606	19.057	0.329	1.013	8.92
Available Fe (mg/kg)	4.605	5.429	5.246	0.083	0.257	8.19
Available Zn (mg/kg)	0.519	0.635	0.603	0.011	0.033	9.18
Available Cu (mg/kg)	0.227	0.287	0.274	0.005	0.016	10.09
Available Mn (mg/kg)	11.416	13.530	13.286	0.230	0.709	9.02

Table 8: Physical and chemical properties of soil under low cost natural farming, organic farming and conventional farming (*Kharif*)

Particulars	LCNF	OF	CF	S.Em.±	C. D. at 5%	C.V.%
Bulk density (Mg m^3)	1.454	1.334	1.375	0.014	0.042	4.87
Porosity (%)	45.230	48.989	47.916	0.434	1.337	4.58
Water holding capacity (%)	41.355	44.586	43.644	0.371	1.142	4.29
Organic carbon (%)	0.533	0.689	0.658	0.010	0.031	8.02
Available N (mg/kg)	117.07	122.39	140.17	4.397	13.550	8.91
Available P(mg/kg)	16.09	18.17	23.47	0.752	2.316	10.02
Available K (mg/kg)	123.14	128.66	147.40	4.323	13.320	8.33
Available S (mg/kg)	17.240	20.937	20.124	0.356	1.097	9.16
Available Fe (mg/kg)	4.849	5.930	5.665	0.095	0.294	8.69
Available Zn (mg/kg)	0.539	0.694	0.663	0.011	0.035	9.05
Available Cu (mg/kg)	0.243	0.329	0.312	0.006	0.019	10.54
Available Mn (mg/kg)	11.757	14.807	14.291	0.281	0.866	10.32

Table 9: Economics of crops grown under low cost natural farming, organic farming and conventional farming (*Rabi*)

Particular	LCNF	OF	CF	S.Em.±	C.D. at 5%	C.V. %
Gross returns (USD/ha)	886.73	1133.97	1354.33	1680	5176	9.61
Cost of cultivation (USD/ha)	472.21	681.55	572.54	-	-	-
Net returns (USD/ha)	414.52	452.42	781.79	1680	5176	19.68
B:C ratio	1.88	1.66	2.37	-	-	-

However, the net returns, minimum gross returns and B:C ratio were achieved with the Module-I (LCNF).During summer, an evaluation of the data (Table 10) showed that maximum gross returns (USD 1928.04/ha) and net realization (USD1381.76 /ha) were obtained under growing of chemically treated sole groundnut and sesame (CF), followed by the Module-II which included biofertilizer, vermicompost, FYM, *Panchagavya* and biopesticides (OF). Whereas, the lowest gross returns and net returns (USD1341.04/ha and USD 843.87/ha) was observed with crops grown under the low cost natural farming (LCNF). in the course of *kharif* season, the findings (Table 11) demonstrated that the module-III that involved application of industrial chemicals like, NPK fertilizers, fungicides, insecticides and herbicides (CF) resulted in higher gross returns (USD 2395.97/ha), net returns (USD 1782.27/ha) and B:C ratio (3.90), followed by application of biofertilizer, *Panchagavya*, FYM, vermicompost and biopesticides (OF) and application of cow based bioenhancers and botanicals (LCNF). Maximum gross and net returns were obtained under the CF.

Table 10: Economics of crops grown under low cost natural farming, organic farming and conventional farming (Summer)

Particular	LCNF	OF	CF	S.Em.±	C.D. at 5%	C.V. %
Gross returns (USD/ha)	1341.04	1770.21	1928.04	2879	8870	11.03
Cost of cultivation (USD/ha)	497.17	694.03	546.28	-	-	-
Net returns (USD/ha)	843.87	1076.18	1381.76	2879	8870	16.84
B:C ratio	2.70	2.55	3.53	-	-	-

Table 11: Economics of crops grown under low cost natural farming, organic farming and conventional farming (*Kharif*)

Particular	LCNF	OF	CF	S.Em.±	C.D. at 5%	C.V. %
Gross returns (USD/ha)	1663.16	2082.72	2395.97	2793	8607	8.78
Cost of cultivation (USD/ha)	606.74	749.83	613.70	-	-	-
Net returns (USD/ha)	1056.42	1332.89	1782.27	2793	8607	12.93
B:C ratio	2.74	2.78	3.90	-	-	-

This might be attributed to higher economical yield and biological yield of crops withcomparatively less cost than additional income under this module. The minimum gross returns andnet returns were achieved under the LCNF which might be due to variation in the economical and biological yields of crops. These results are similar with results of Chaurasia*et al.* (2014), Behera and Rautaray (2010), Singh *et al.* (2018) and Lyngdoh *et al.* (2019).

Conclusion

With the evident of three-season field experimentation, it may be finalized that conventional farming system comprised of mineral fertilizers, FYM and pesticides was found superior as compared to organic farming and low cost natural farming for obtaining higher yield of major field crops along with higher net returns shows slight improvement in soil physical and chemical properties although it is just one year experiment which is conducted under medium black calcareous clayey soil of South Saurashtra Agro-climatic Zone of Gujarat.

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Conflict of interest

The authors declare that they have no conflict of interest.

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